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Practical and Theoretical Mechanics and Chemistry.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Examination of some of the Anthracites found in Sugar Loaf Township, Luzerne County, Pennsylvania. *By* PROFESSOR W. R. JOHNSON.

The value, for economical purposes, of careful examinations of mineral fuel must be apparent when we consider the multifarious uses to which such fuel is already applied, and the certainty that far greater extension must ere long be given to it, especially in the application of anthracite to various manufactures of iron and other metals, to locomotion on land, and to steam navigation on the ocean. To subserve these different purposes, various qualities are required in the fuel adopted, and the absence of noxious ingredients must be previously ascertained, in order to insure the applicability of any given variety of coal. I may observe that however extended may be the uses of anthracite, whether for domestic consumption, for locomotion, for the prosecution of the arts, or for commercial and naval steam navigation, Pennsylvania seems destined to supply the United States with this most important article of fuel. In this view of the subject I have devoted what leisure I could command for some years past, to inquiries relative to its various properties, and to the means of rendering it available in the several ways above referred to.

I should state that the site from which the samples were taken, is on the northern side of Hazle Creek Valley, at the base of Corneil Ridge, about two miles distant, in an easterly direction, from the mines of the Hazleton Coal Company, and about three fourths of a mile from the Rail Road of that Company, with which the Sugar Loaf Coal Company's mines are connected by a branch road.

The bed of coal conforms in *direction* with the general direction of the ridge, at the base of which it lies, and indeed of most of the parallel ridges in that section of the country, being about north 80 degrees east. Its in-

clination at the surface, or outcrop, is 32½ degrees, but within a few yards of the surface this is changed to 27½ degrees, which angle it maintains to the present depth of the slope, or about 250 feet. This degree of inclination gives to every acre of land measured on the *horizontal surface, one and one eighth* acres, as measured on the inclined surface of the coal bed.

The entire thickness of the carbonaceous deposit on which the present works of the company are established, including that of the slates intervening between the several seams of coal, is something more than thirty-one feet.

This is the result of measurements taken perpendicularly across the thickness of the beds in the vertical shaft sunk near the mouth of the slope, and now used as an air shaft. The several members of the series will be found to correspond very nearly to the following section beginning at the surface of the ground, viz.

	Feet.	Inches.
1. Earthy surface soil,	2	0
2. Decomposed carbonaceous matter or "black dirt,"	6	6
3. Coal with partings of slate,	8	0
4. Slate,	0	3
5. Good coal,	1	6
6. Bony coal,	1	1
7. Good coal,	2	0
8. Slate,	0	6
9. Good coal,	6	2
10. Bony coal,	1	5
11. Good coal,	4	1
	33	8

Besides this series, disclosed at the period of my visit, subsequent explorations have, I am informed, developed other beds both superior and inferior in the order of stratification, to that now worked.

Three specimens of the coal have been particularly examined.

No. 1 was from the pit above referred to, about thirty yards in advance of the opening at which the "slope," or inclined railway, is now carried down.

No. 2 was taken from the slope at about 100 feet from its mouth, and from the upper part of the ply of good coal, No. 9 of the above section.

No. 3 was from the bottom of the same ply, and about the same depth on the slope.

No. 1 is compact in structure, giving conchoidal fractures in all directions, apparently indifferent to the surfaces of deposition which are manifested only by alternating lines or seams of blueish black and jet black, which mark the successive layers. The appearance gives the idea that these surfaces have been in a great measure obliterated, while the whole mass was, from some cause, in a semifluid state. The specific gravity of this specimen is 1.591; consequently a cubic foot of it would weigh 99.46 pounds; and a cubic yard, 2694.81 pounds, or one and one fifth tons. Had the whole bed No. 9 of the section, 6 feet 2 inches thick, possessed the same specific gravity, there would, with the inclination above mentioned, be found 13,431 tons to the acre, horizontal measurement, and the whole deposit, if we include the layers No. 3, 5, 7, 9 and 11, being 21 feet 9 inches in thickness of *coal*, would give 47,375 tons per acre. This must, however, be taken with due allowance for pillars to the mine and waste in working,

which will be greater or less according to the manner in which operations are conducted.

When heated to a temperature sufficient to expel the water which it contains, without decomposing it,

		Per Cent.
The specimen No. 1 lost		1.915
When the dried coal is ignited to redness for some time in a close vessel, it yields carbonic oxide and carburetted hydrogen, with a small portion of sulphur,		5.068
The remaining fixed carbon is		88.187
Earthy matter 4.83 per ct. viz.	Silica,	2.589
	Alumina,	1.772
	Peroxide of iron,	.270
	Lime,	.138
	Magnesia,	.052
	Protoxide of manganese,	.009
		100.

From the latter numbers it will be perceived that of the fixed ingredients or ashes of this coal, 100 parts will be composed of

Silica,	53.603
Alumina,	36.687
Perox. of iron,	5.590
Lime,	2.857
Magnesia,	1.076
Prot. manganese,	0.186

The ashes of this coal are of a yellowish white or very light buff colour, and very bulky.

Specimen No. 2 has a specific gravity of 1.574, from which it will be found that a cubic foot weighs 98.37 pounds, and the cubic yard 2663, or a trifle less than one and one fifth tons.

The colour and other external characters of this coal are similar to those of No. 1, but it was remarked that the surfaces of deposition are even more completely obliterated than in that specimen; and that in the direction of those surfaces, no even faces could be procured in fracturing the coal; while in planes at right angles to those surfaces, it has a "grain" or "sline" represented by exceedingly thin plates of white earthy matter, along which fractures frequently occur.

By heating to a temperature of 370° Fah. this coal loses		2.196 per ct.
By heating to whiteness in a close vessel, it gives of carbonic oxide and a little carburetted hydrogen,		3.165 "
The carbon not capable of being volatilized by simple heat, is		85.909 "
Its earthy impurities, including oxides, amount to 8.73 per ct. viz.	Silica,	3.938 "
	Alumina,	3.230 "
	Peroxide of iron,	1.135 "
	Lime,	.120 "
	Magnesia,	.120 "
	Loss,	.015 "
		100.00

The proportions of the several ingredients of the ashes of this coal are somewhat different from those of No. 1. Thus the Silica is 45.105 per ct.

Alumina,	37.000 "
Peroxide of iron,	13.000 "
Lime,	1.380 "
Magnesia,	2.430 "
Loss,	1.085 "
	100.000

The ashes are nearly white, or with a very slight tinge only of red, and are distinguished from those of No. 1 by a far greater *density*, being under a given bulk about two and a half times as heavy as the latter. A larger portion of oxide of iron and of magnesia will be observed in the second than in the first analysis. The above portion of peroxide of iron is equivalent to 9.1 per cent. of metallic iron; and if this circumstance were essentially important in the production of iron in the blast furnace, might lead to the inference that this coal would be more valuable than No. 1 for that manufacture, but the nearly double amount of earthy matter to be smelted, and especially the presence of a greater quantity of magnesia would render this at least doubtful. When this variety of anthracite shall be employed for smelting iron in the blast furnace, it will probably be found expedient to use in addition to the flux required by the iron ore, about 4 or 5 per cent of the weight of coal, in *limestone*, to reduce the cinder of the coal. At a temperature sufficient to smelt the iron ore of Beaver Meadow, this addition will be found to reduce to a porous cinder the ashes of the coal now under consideration.

Specimen No. 3 was taken from the bottom of the same bed (No. 9 of the section) as No. 2, and was found to have a specific gravity of 1.55, consequently one cubic foot of it will weigh 96.875 lbs., and one cubic yard 2615.625 lbs. or 1.167, say *one and one sixth* tons.

The colour of this coal is a deep and nearly uniform black—shining. Fracture irregular, splintery.

	Per Cent.
The water in this coal was found to be	2.250
Loss by heating for some time to whiteness, gas burning with blueish white light,	4.625
Carbon not volatile at a white heat,	90.705
Earthy ingredients 2.242 per ct. composed of	
Silica,	1.071
Alumina,	.965
Peroxide of iron,	.135
Lime,	.141
Magnesia,	.073
Oxide of manganese, trace,	
	99.965

It appears therefore that this is considerably richer in carbon than either of the other specimens, and that its earthy residuum is but little more than one fourth as great as that of No. 2.

The proportion of the several ingredients of the ashes it will be observed, is

Silica,	43.68
Alumina,	39.34
Peroxide of iron,	8.22
Lime,	5.76
Magnesia,	3.00
	100.00

This specimen has, therefore, both in the amount of its solid carbon and in the small proportion of its earthy residuum a considerable advantage over either of the preceding. Its specific gravity is also the lowest of the three. The density of its ashes is intermediate between that of 1 and 2 being exactly three fourths as great as the latter, so that the density of the residuum of No. 1 is represented by 8

That of No. 3 by 15

That of No. 2 by 20

By an average of the three analyses above given, it will be seen that the

proportion of water in this coal, is	2.120	per cent.
The other volatile ingredients are	4.286	"
The earthy matter, oxides, &c.	5.326	"
Carbon,	88.268	"
	100.	

Hence the combustible matter, including the gaseous and solid materials, amounts to 92.552 per cent.

In conclusion, I may observe, that while these analyses demonstrate the high density and compactness of this coal, fitting it for the purposes of steam navigation, for which these qualities, combined with great heating power, are of primary importance; they also show that for the various arts and for domestic consumption its properties are calculated to sustain the high character of the central coal field of Pennsylvania, for the solid and durable heat which it furnishes, and the absence of those ingredients which might interfere with its useful application.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Warming of Rooms by heated Air. By Wm. Gries, M. D.

Womelsdorf, Berks county, Penn., July 12th, 1839.

Having been placed, some years ago, in a situation, in which I had to provide for the most comfortable and healthful warming of an apartment, appropriated to the instruction of youth, after trying various modes, in common use, I concluded it best to introduce heated air from a hot chamber; and in effecting this I was led to think, that the principle upon which it should be done is, at least, not well understood. In none of the works treating on heat and pneumatics, that have fallen under my notice, have I seen proper directions given. The principle, however, when explained, is so simple, that I feel diffident in attemping to make any communication upon it; but if it be correct (and as I find, that in your public buildings, where it is most needed,—such as the Exchange, Philadelphia Museum, U. S. Bank, most of your Churches, &c., this principle is not applied) I think it my duty to communicate my views.

It is manifest that when heat is introduced into a chamber, and the air is

in consequence expanded, the wall making a resistance on all sides, there must be a certain force or impetus communicated to this heated air, which impels it through any opening made in the room. The place of exit is generally made at, or near, the top of the hot chamber, to communicate with the apartment to be warmed. The hot air being aided by the cold and heavier air on the outside of the chamber, pressing in by the feeding holes at the bottom, the force or momentum thus produced is expended in whatever direction the communication is made. If it be through a mere opening in the floor, as is generally done, the impetus, in connexion with the well known property of air (the colder and heavier pressing downward and displacing the warmer) carries it vertically to the ceiling of the apartment. And when there, what is it that will bring it down? It evidently cannot come down in any part of the apartment, where the air below is colder, and it is therefore only by a long continued process of introducing heated air that the apartment can be rendered comfortable, if at all, where the ceiling is very high. Now in my opinion, it should be so introduced, that while it is yet in a constrained passage, it should be directed horizontally along the floor, and this as nigh the floor as is safe to prevent ignition; and there should be no solid obstacle to interrupt its course. It will then only be displaced by the colder and heavier air pressing down and taking its place: then, whatever be the height of ceiling, we get at least the benefit of the warmed air in its transmission.—But some will say, this is nothing new; we have seen many places where the heated air is admitted in this way. Very true, but this was most probably by mere accident, where it happened to be the most convenient arrangement, and not upon any well understood principle; for if these views are correct why are they not acted upon in those buildings where an efficient mode is most needed? Others may doubt the correctness of my views, and without making experiments, condemn them; to such I would say, that I practically proved them, in the school room, already spoken of. This room is twenty-nine feet square, and fourteen feet high—the furnace was placed centrally in the cellar, and the heated air passed through a grate in the floor.—For two winters we burned nearly seven tons of coal, each winter,—for we had to keep up the fire at night, to render it even tolerably comfortable, yet the inmates always complained of cold feet. Last winter I placed a drum of sheet iron over the grate, which is thirteen inches diameter, and has three pipes jutting from its sides, five inches diameter, six inches long, and six inches from the floor:—now during the whole winter we burned but a little more than four tons of coal; the room was always more than merely comfortable, and the inmates declared that their feet were the warmest parts of their bodies: moreover, I found that the thermometer was only two degrees lower, when placed on the floor, nigh the wall, than it was within a few feet of the ceiling.

In addition I would say, that where the saving of fuel is at all important, and the purity of the air not so essential, we might have holes in the floor, in several extreme points of the apartment, and pipes leading from these to the bottom of the hot chamber, to supply air:—by this means we should withdraw the cold air from the floor of the apartment, it being always the lowest stratum, and supply its place by a stratum of warm air. By this mode, the atmosphere of the room would be at least as pure as when it is heated by radiation from a stove or fireplace. It may be objected, that by withdrawing the air we should invite more cold air through doors, windows, &c., but this is incorrect, for by whatever mode we warm an apartment, so

long as the external air is colder, it will intrude by its greater density and weight.

Observations.—The experimental fact stated by Dr. Gries is valuable. If hot air from below enters an apartment to be heated, in horizontal currents, its heat will be sooner and more effectually imparted to the lower strata of the atmosphere of the room than if it ascend in vertical columns as is usually the practice. The complaint of cold feet, in parlours heated by warm air, is, if we are not mistaken, very common; and when the feet are cold, the whole system partakes more or less of the discomfort. This is perhaps the main reason why in rooms thus heated, persons who have been accustomed only to radiated heat complain sometimes of chilliness, when the thermometer on the mantel indicates a high temperature. We are not quite so sanguine, however, as to think that a simple change in the direction of the current, as practised by our correspondent, would in all cases produce a saving of three-sevenths of the fuel, while it adds to the comfort of the apartment. The experiment is worthy of acceptance. We would invite from our readers an account of good results on the heating of rooms by warm air. G.

Civil Engineering.

On the Tractive Power of the Horse. By Ellwood Morris, *Civil Engineer.*

There are perhaps but few subjects concerning which writers on practical mechanics differ more essentially than in stating the mean tractive force capable of being maintained by horses in common working hours from day to day.

Practical men seeking to apply horse power to various purposes, find upon resorting to books, such discrepancies as shake their confidence in the statements, even of the most respectable authorities, and induce them rather to assume for themselves an empirical standard.

At first view it would appear that a power of such antiquity, so commonly employed, and apparently so susceptible too of direct appreciation by experiment, would long since have received a determination, closely approximating to accuracy.

A nearer examination, however, developes difficulties growing out of the variety in muscular strength, to be noticed among horses even of the same weight, the difference in the capacity of prolonging exertion or keeping up a given pull for stated periods, which may be found amongst those of equal momentary strength, and the difficulty in experiments of registering the direct draught, owing to the traction being effected by *impulses*, "or strokes of the animals' shoulder against the collar," as aptly stated by an eminent writer.*

Another source of difference, much to be regretted, is that our authors do not always tell us, whether or not the tractive force given by them is the *effective draught* clear of friction.

The following Table 1, exhibiting the tractive force of the horse as stated by various authors,† shows considerable differences, and might be further

* John Mackneill, Esq. C. E. &c. See Trans. Instit. Brit. Civ. Eng.

† See Emerson's Mechanics; Allen's Mec.; Gregory's Math.; Wood on Rail Roads; and Tredgold on Rail Roads.

extended, but that we have not the books at hand. In compiling this table, we observe that Mr. Smeaton's determination of a horse's power is stated at 250 hhds. of water *actually lifted* 10 feet high by pumps in one hour by one horse. We have therefore thought ourselves authorised in adding $\frac{1}{3}$ to this result for the friction of the pumps. The statements of the other authorities quoted, we take to be *total draught*, including friction.

TABLE I.

1	2	3	4	5	6	7
Direct Draught.	Speed per hour.	Duration of the draught or hours wrought per day.	Pounds lifted one foot high per minute.	Effect in lbs. lifted one foot high per day of the stated number of working hours without deduction for friction.	Authorities.	Species of draught.
lbs.	Miles.	Hours.	lbs.	lbs.		
200	2½	8	44,000	21,120,000	Emerson.	Over a pulley.
125	2½	8	27,500	13,200,000	Desagulier.	Unknown.
150	2½	8	33,000	15,840,000	Boulton & Watt.	do.
121 7-10	2½	8	26,774	12,851,520	Smeaton.	Pumping water.
163	2½	8	35,860	17,212,800	Bevan.	In ploughing matches.
112	2	10	19,712	11,827,200	Wood.	On Rail Roads.
125	3	6	33,000	11,880,000	Tredgold.	do.
90½	2½	8	19,855	9,530,400	Leslie.	Common horse.
156½	2½	8	34,375	16,500,000	ditto.	Picked do.

Having for the last two years daily witnessed the application of horse power, to hoisting weights by simple machinery, we have thought it would not be without interest to practical men, to state the usual results of the labour of horses, under the circumstances referred to. It will at least be adding another direct fact to the information we now possess in regard to the tractive force of those animals.

The horse draught to which we allude is applied to gins (at the tunnel now constructing on the Chesapeake and Ohio Canal) in hoisting out by open buckets the water which accumulates in the shaft workings. The particular shaft (D*) where our experiments were made, is 188 feet deep, and usually has a hoist (clear of water surface in the sumph) of 178 feet. Two buckets are worked in this shaft, by ropes winding in reverse order around a drum, so that when one bucket is ascending, the other is descending, the direction of the horse's motion being reversed at the banking of each successive bucket, so as to produce on the whole, a reciprocating circular motion.

Dimensions about the Gin.

Hoist clear of the sumph, ...	178 feet.
Circumference of gin rope drum, ...	29.15 feet.
Do. of gin horse path, ...	89.85 "

* See Journal Franklin Institute, vol. xxiii., page 24.

Ratio of motion of horse to that of the bucket, ... 548 to 178
Circumference of the hemp rope, ... 5 inches.
Cubic contents of water in each bucket as it usually reaches top shaft, ... $8\frac{4}{10}$ cub. ft.
Average friction of the gin, with the buckets empty in lbs. applied at the horse's yoke, ... $23\frac{1}{4}$ lbs.
Average friction of the gin when loaded with $8\frac{4}{10}$ cubic feet of water, (525 lbs.) and moving at the usual pace, in pounds, applied with a steady pull to the horse's yoke, . . . 26 lbs.
Ratio of the additional friction ($2\frac{1}{4}$ lbs.) to the applied weight, (525 lbs.) . . . . . $\frac{1}{310}$ of the weight.

The following Table II, exhibits the mean results of four different series of experiments gone into with the view of ascertaining the actual average draught of the gin horses working during one "miner's shift," or 8 hours out of 24.

The draught noted in the table below, is inclusive of the friction of the machinery, rigidity of the cordage, &c., which at a mean of twelve experiments, proved to be equal to 26 lbs. when the load was 525 lbs. as before stated.

All the experiments were made with two different animals (Nos. 1 and 2) of medium size and strength for ordinary horses.

TABLE II.

1	2	3	4	5	6	7	8
Experiments.	No. of the horse.	Total time of horse hitched up.	Time lost in every way per shift of 8 hours.	Time per shift of horse actually hoisting the weight.	Pace of the horse whilst actually lifting the weight in miles per hour.	Average draught while actually hoisting.	Dynamical effect produced by one horse in lbs. lifted one foot high per day of 8 working hours, without deduction for friction.
		Hours	h. m. s.	h. m. s.	Miles.	Pounds.	Pounds.
Average of the 1st series.	1	8	2 38 00	5 22 0	2.321	$196\frac{1}{2}$	12 922 384
Average of the 2nd series.	2	8	2 16 12	5 43 48	1.956	$196\frac{1}{2}$	11 628 399
Average of the 3rd series.	1	8	2 8 0	5 52 0	2.265	$196\frac{1}{2}$	13 768 566
Average of the 4th series.	2	8	2 0 0	6 0 0	2.076	$196\frac{1}{2}$	12 923 349

The actual amount of water lifted from the workings, by each horse in 8 hours work, and hoisted 178 feet, was found to be, on an average of all the experiments, near 62,475 lbs. or = 11,120,550 lbs. lifted *one foot* high per day.

In performing the above work from day to day, we have noticed that the horses employed barely kept in condition, thus signifying that they were working near to their maximum power.

We may divide horses generally into two classes, *picked* and *common*. And referring to tables I. and II., and selecting from the first those results

which seem most conformable to practice, we shall find that the dynamical effect produced by

PICKED HORSES

According to Boulton & Watt, = 15,840,000
Do. Bevan, = 17,212,800
} Pounds lifted one foot high per day.

2)33,052,800

Average = 16,526,400

COMMON HORSES

According to Desagulier, = 13,200,000
Do. Smeaton, = 12,851,520
Do. gin horses C and O = 12,922,384
= 11,628,399
= 13,786,566
= 12,923,349
} Pounds lifted one foot high per day.

6)77,312,218

Average = 12,885,369

Whence finally we may perhaps take the mean day's work of horses when fully loaded.

Of { *Picked* horses at $16\frac{1}{2}$ *millions* of lbs. lifted one foot high per day.
{ *Common* do. at $12\frac{9}{10}$ do.

This average result for *common* horses is equal to a continued pull of near $135\frac{3}{4}$ lbs. at the rate of $2\frac{1}{4}$ miles per hour for* 8 hours out of 24.

The pace of $2\frac{1}{4}$ miles per hour, or more accurately 200 feet per minute, has been ascertained by the writer from numerous experiments upon horses hauling earth for embankments in single carts, as well as from some trials with teams of four, to be that at which those in common use on public works, generally proceed when working with full effect.

Oldtown, Md., July 15th, 1839.

Description of a Natural Bridge in Claiborne county, Tennessee.

By John C. Trautwine, *Civil Engineer.*

To the Editor of the Journal of the Franklin Institute.

Presuming that such subjects come within the scope of your Journal, I send you a description, and drawing, which I recently made of a Natural Bridge, hitherto undescribed, in Claiborne county, Tennessee.

It is generally supposed that Virginia possesses the only Natural Bridge in the country; viz: the one over Cedar Creek; but that is not the case; there are several others in East Tennessee, and Western Virginia, though all must yield in sublimity and grandeur to that over Cedar Creek. The one which forms the subject of this paper, spans the narrow valley of Gap Creek, a small stream which issues from the mouth of an extensive cave, at

* The horses employed upon public works, averaging the working time of the whole year, are worked nearly 10 out of 24 hours, for which time, however, they would only be able to exert a mean force equal to a steady pull of about $108\frac{1}{2}$ lbs., and the pace and the dynamical result would both be found to remain nearly as above.

Cumberland Gap. It stands about five miles S. W. from the Gap, and is so little known, that but few persons even in its immediate vicinity, are aware of its existence; indeed it is only crossed at times, by the few persons engaged on the farm, and had never been visited through curiosity, until the party of which I formed one, determined to settle the disputed point of its existence.

It stands in a wood, about a mile north of the stage road from Jacksboro' to Cumberland Gap, and, as before remarked, about five miles S. W. of the latter point. The ravine across which it is thrown, is, just here, quite wild and romantic; being narrow, and bounded by masses of rock, either perpendicular, or over hanging, varying in height from fifty to one hundred feet; the average width of the valley does not, at the site of the bridge, much exceed thirty feet. The impressions it produces are, therefore, not so much those resulting from actual magnitude, as from the apparent size caused by proximity to it.

It is very evident to me that this bridge has, at some distant period, formed part of a cave, of which the overhanging rocks above and below it, have constituted the side walls; and the great fragments of sharp-angled masses, which in some places nearly block up the ravine, the roof. Immediately under the arch, these fragments are strewn to a depth of twenty feet; and a few yards below it stands a mound of very regular shape, perhaps forty feet in diameter, and as many in height, which I ascribe to the same source. This mound is shown in the drawing, where it conceals nearly two-thirds of the opening of the bridge; a view exhibiting the entire arch could not be had, as the mound extends entirely up to the bridge. This

mound resembles in every particular, the Indian burial mounds, so common all over this section; and perhaps it would be safer to assume it to be, *in part*, the work of that people; especially as we can scarcely imagine that exposure to the weather, would crumble down the fragments of rock into soil, with such perfect regularity as the mound exhibits. Trees grow on it, which indicate that its formation took place some time ago; while large, sharp, and freshly broken fragments which cover its base, indicate that the process is not yet complete.

A strong evidence of the former existence of a cave, is that the creek here flows not *in*, but *beneath* the bed of the valley, having I suppose been forced to seek its subterranean channel, by the obstructions offered to its original course, by the falling-in of the roof of the cave; it issues from the ground some few rods below the bridge. Like most of the streams in this vicinity, however, it sinks into the ground, and reissues in many places.

The height of the roadway above the valley, would, if the fallen blocks were cleared away, be about seventy feet; the span at the bottom is about twenty-five feet, but at top, not more than twelve, forming a kind of rude parabola. The width of the roadway is fifteen feet; and the thickness of the arch in the centre, not more than two and a half feet. From its being much cracked, it has every appearance of soon falling in; there is, however, a farm road over it, the wagons of the farm cross it in safety, and it may, perhaps, endure for centuries to come.

The rock is a grey, stratified limestone, which, just at the bridge, approaches to a slaty structure; the strata lie parallel to the nearly horizontal roadway; and indeed the thickness of the arch at top, is composed of one flat layer, extending across it. The adjacent rock is more compact.

I was much struck with the appearance of this bridge, more especially as I had been half inclined to doubt its existence, and it was, therefore, rather an unexpected treat. I consider it certainly the wildest and most romantic little *morceau* of scenery I have ever seen. It cannot, of course, compare with the stately grandeur of the Cedar Creek Bridge; but still in consequence of the almost immediate contact into which you are brought with it, and the idea which forces itself upon you, that you are shut up with it, from the rest of the world, by the overhanging rocks of the ravine, render it very interesting, and you gradually contract quite an affection for it. I made a careful drawing of it on the spot.

Before concluding, I must remark that the vicinity of Cumberland Gap is one of the most interesting places I have ever visited. The surrounding mountain scenery is magnificent; and the whole of East Tennessee, East Kentucky and Western Virginia abound in caves, natural tunnels, and bridges, to such an extent that the traveller can scarcely stop at a house, whose inmates cannot in a few minutes, conduct him to either one or the other. The geological features of the country are of unusual interest; coal, lime, sandstone, gypsum, iron, lead, salt, &c. &c., abound throughout; and mineral waters of various descriptions are to be met with in every part.

I found in the immediate vicinity of the Gap, a variety of iron, which is new to me, and probably to mineralogists, as I have never seen descriptions of any resembling it. It is a compact red oxide, of a stratified structure, and consisting almost entirely of vegetable remains, exhibiting distinct impressions of leaves and nuts. It has a granular appearance throughout, produced by an immense number of flattened globules, evidently vegetable, and probably seed, which constitute the greater portion of the mass. This iron formation is very abundant here, it is associated with red shale, and is

worked as an ore; it yields about fifty to sixty per cent. of pure metal. The workmen mistook the globules for the common granular ore.

I forward to you a few specimens, for the cabinet of the Institute; together with a specimen of native iron, from Cocke county, Tenn.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1838,
With Remarks and Exemplifications by the Editor.

1. For *Manufacturing Leaden or other Metallic Pipes;* R. M. Seydle and Lewis Ward, Northumberland county, Penn., August 1.

The lead or other pipe to be manufactured is to be cast upon one end of a polished iron mandrel, and is then to be passed between rollers which have grooves turned on them in the manner of those used for rolling round bar iron, the grooves successively diminishing in size. The claim is to this process or method of forming metallic pipes.

2. For *Cards for Carding Cotton, Wool, &c.;* George Faber, Canton, Stark county, Ohio, August 1.

The card intended is the common hand card, and the patent is obtained for using a foundation of wood instead of leather for containing the teeth. A veneer is to be cut of a suitable thickness, and reduced to the proper length and width, and this, after being steeped in water, is to be put into the card machine where it is to be pricked and stuck with teeth, in the same manner as leather is stuck. There is not any claim made to the machine, but only to the use of the foundation of wood.

3. For an improvement in the mode of *Converting a Reciprocating into a Rotary Motion;* Charles A. Watson, Green River, Kentucky, August 1.

There may be cases in which a device like that which is the subject of the present patent may be of use, as the changing of a reciprocating into a rotary motion, is a thing often required in machinery of different kinds. The patentee states that he has "invented a new and improved mode of arranging a double rack and ratchet wheel, in virtue of which arrangement the racks engage with and disengage from the ratchet wheel in a more perfect and advantageous manner than by any of the plans heretofore adopted;" all of which may be correct, but whilst the general intention is to apply such an apparatus as a substitute for the crank in steam engines, it must prove an utter failure; in several of the plans which have been tried the difficulty has not been in the manner of arranging the parts, the defect is more deeply seated, being inherent. The crank, instead of being liable to the objections which have been urged against it, is, we believe, perfect in its action, and, if so, all substitutes must be bad in principle.

The patentee confines his claim to the peculiarities of his mode of arrangement, which we shall not attempt to particularize.

4. For an improvement in *Fire Arms,* applicable alike to smal

arms and Cannon; Hezekiah L. Thistle, New Orleans, Louisiana, August 1.

The chamber part of the fire arms, whether of the musket or cannon kind, is attached to the breech by a joint pin, so that it may be turned up to receive its charge. The chamber part is provided with a rim which fits into a corresponding recess turned out in the rear end of the bore of the barrel, which device the patentee denominates a flute joint. The chamber part is made capable of receding, and is born up by a wedge after it has received its load. When this device is applied to cannon, they are to be made of wrought iron. In muskets a sword is to be substituted for the bayonet, there being proper devices on the handle for shipping and unshipping it. The claims made are to "the tail piece, the flute jointed chamber, connected by a joint; the wedge, oval rollers, bed, and springs, in combination therewith; the manner of shipping the sword; the flute jointed chamber and its guide screw or bolts, the bed, wedge, racks, pinion, cam and cranks, in combination applied to cannon and field pieces, operating as described."

The claim, it will be seen, is to a number of minute particulars in the mode of constructing the apparatus, not admitting of verbal description. Some of the things named are not new in their individual capacity, and if sustained, can only be so in their peculiar combination.

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5. For *Manufacturing Leather*; Adam Hickman & Edwin L. Davenport, Abingdon, Washington county, Virginia, August 1.

(See Specification.)

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6. For an improved *Adhesive Compound for Binding Books;* David Felt, city of New York, August 1.

(See Specification.)

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7. For improvements in the *Brewing of Beer, &c.;* Thomas Behan, Norwich, Chenango county, N. York, August 1.

(See Specification.)

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8. For an improvement in the manufacture of *Ploughs of Cast Iron;* Cyrus Alger, Boston, Massachusetts, August 3.

(See Specification.)

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9. For an improvement in *Generating Steam;* Phineas Bennet, City of New York, August 3.

The claim under this patent is to "the employment and construction of an air tight furnace into which air is to be blown under considerable pressure, combining with said furnace the cap valve, as described, with its appendages, or any other similar apparatus constructed so as to operate substantially in the manner set forth; I do not claim the air tight furnace with its blast, independently of the above named combination. I likewise claim in combination with such a furnace and cap valve, or any other analogous apparatus, an air tight reservoir for fuel, constructed in the manner, and for the purpose of supplying the furnace with fuel without interfering with the pressure of the blast by which the combustion is kept up.

The engine which is above referred to was intended especially for ocean service, and a large amount of money has been expended in the essays made with it, but, as is commonly the case in such undertakings, many difficulties

have been encountered; the plan, however, has not been abandoned, and it is still hoped that the engine may be made a useful one. What is called the cap valve, was esteemed a principal feature in the improvement, most of the other devices having been used in different combinations. The cap valve is intended to force all the gaseous products of combustion to pass through the water in the boiler, which it effects in the following manner. These products of combustion ascend through a flue which terminates a short distance above the surface of the water in the boiler; the cap valve is an inverted vessel, the mouth of which dips into the water surrounding the flue, so as to force the heated air to pass down through said water; the cap valve is made adjustable so as to dip into the water to such distance as may be found most beneficial.

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10. For *Protecting Notes, Checks, &c. from alteration;* Ebenezer Watson, Albany, New York, August 3.

(See Specification.)

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11. For an improvement in the construction of the common *Hand Bellows;* John Grennell, Springfield, county of Hampden, Massachusetts, August 3.

The hand bellows, which is the subject of this patent, resemble the ordinary smith's forge bellows; that is, to say, there are three boards, the middle one being fixed, and the upper and lower boards being moveable; to the two lower boards there are handles, and they have both valves or clacks, opening upwards. Between the two upper boards there is a spring which draws them together, and thus supplies the place of the weight in the forge bellows. The wind escapes from the upper compartment, through the nozzle. The bellows may be used with either side upwards. The claim is to the use of the spring as set forth.

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12. For an improvement in the *Peck-hammer, for pecking Mill and other Stones;* Bela Gardiner, Ashfield, Franklin county, Massachusetts, August 3.

Peck-hammers have been made by taking two pieces of iron, each in the form of a half hammer, and securing a plate of steel between them, by means of screws or wedges; the present patent is taken for an improvement in this kind of hammer. The steel plate is to be upset at its upper end so as to form a ledge on each side. The cheeks of the hammer have several grooves along their inner sides, from front to back, to admit these ledges, and the steel plate, as it wears down, may be lowered by the aid of these grooves, and held firmly when in use. The claim is to "the addition of the shoulders or projections on the upper part of the chisel plate, fitting into the channels in the faces of the cheeks in manner, and for the purpose herein described," &c.

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13. For an improvement in the *Horse Power;* Orrin Straight, Lycoming county, Pennsylvania, August 3.

This horse power is of the kind that has an inclined movable endless floor, consisting of slats of wood united together by jointed straps at their edges. The improvement claimed is to "the manner in which the projections of the pieces which receive the slats are made to bear upon the edges of the straps;" the object being to afford strength to the floor, and check its

tendency to swag; a number of patents have been obtained for the same purpose; but the plan before us appears likely to prove superior to most of its predecessors.

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14. For a portable *Cider Mill and Press;* Frederick Fredley, Sugar Valley, Lycoming county, Pennsylvania, August 3.

This mill and press consists of a box, like a fire engine box, upon wheels. Two vertical cylinders serve to grind or mash the apples, a horse being geared to a sweep upon the axis of one of them. The pommage falls into an interior box, lying horizontally, and within which a follower is to be forced along to press out the cider. The claim is to "the mode of operating the press by means of the double rack, combined with the slide for throwing it in and out of gear; and also the combination of the machine for mashing and reducing the apples, in the manner described; that is, by attaching the pinion which works the rack of the press on to the axis of one of the rollers of the reducing or mashing machine."

We can scarcely conceive of the passing of a patent, under the existing law, with less to merit the character of substantial novelty than that before us; but as in nice weighing the dust may turn the balance, so also in an application for a patent, the turning point may be minute in the extreme; such we think must have been the case in the present instance, and the patent was therefore issued on the point of doubt.

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15. For an improved mode of *Generating Steam;* Horatio Hubbell, City of Philadelphia, August 6.

(See Specification.)

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16. For an improved mode of *Preserving Timber;* Samuel Ringold, of Florida, and Edward Earle, Savannah, Georgia, August 6.

(See Specification.)

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17. For an improvement in the mode of *Preparing Corn Husks for the Manufacture of Paper;* Homer Holland, Westfield, Hampden county, Massachusetts, August 13.

(See Specification.)

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18. For *Constructing Timber Rail Roads by Power Machinery;* James Stimpson, City of Baltimore, August 13.

The drawings appended to this patent are necessarily complex, and the claims refer to the different devices represented in them, and would not, alone, convey any correct idea of the particular manner in which the respective parts of the machinery are arranged. The general object of the invention is the same with that of Mr. Smith Cram, patented on the 14th of June 1838, namely, to drive piles, and to cut off, and grade them, for timber rail roads, passing over low grounds; the apparatus employed being sustained upon said piles, and progressively advancing as the work goes on. The two applications were considered as interfering by the office, and the case was referred to a special board of examiners, under whose decision the two patents were issued in the form which they now bear; we learn, however, that it is the intention of Mr. Stimpson to remodel his apparatus, and to apply for a new patent, and should this be done, we will place the

matter in its amended form before our readers, as fully as the nature of the case will allow.

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19. For a machine for *Cutting, Dressing, and Beading Marble and other Stone, &c.;* John D. Buzzell, Cape Elizabeth, Cumberland county, Maine, August 13.

The patentee says that he has invented a "new application of the use of malleable iron sockets, and malleable steel cutters, to be used in revolving cylinders for the purpose of dressing, grooving, and beading marble, and other stone; and a new application of lateral motion to the revolving cylinder for the purpose of grinding and making even the points or edges of the tools; and in the cast iron cylinders for dressing marble and other stone."

A patent was obtained by Mr. Buzzell for a machine for a similar purpose, on the 15th of May 1837, upon which the present purports to be an improvement; the description given refers to more than twenty figures in the drawings, which are necessary to the understanding of the thing, where much relates to peculiarities in shape, and reference is made throughout to the former patent. We are informed, moreover, that this, in common with several other patented machines for a like purpose, has hitherto disappointed the hopes of the inventor, and when the nature and difficulty of the business to be performed are duly considered, success might surprise us, but disappointment cannot. The claims, as given, would not afford any insight into the particular structure of the parts claimed.

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20. For an improvement in the *Brick Press;* Nathan Sawyer and Thos. W. Smith, Washington, D. C., August 13.

This patent is taken for an improved manner of filling the moulds, and of removing the brick, in machines intended for pressing brick from dry clay, such as that for which letters patent were obtained by Nathan Sawyer, on the 8th of April 1835, but which may also be applied to other machines.

The pulverized clay is to be put into a hopper, and under this hopper there is a sliding feeder having an opening through it to contain clay enough to fill the mould, and this being made to traverse backward and forward, receives the clay from the hopper, and deposits it in the mould, in doing which it pushes off the brick last moulded.

The claim is to "the whole arrangement of the feeder taking its supply from the hopper, supplying the mould, and removing the pressed brick, as set forth; also the application of the box within the hopper, which is attached to the hopper by cloth or leather passed loosely over the top of the box, to allow said box to pass freely up and down over the surface of the feeder, as described."

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21. For an improved method of *Attaching Awls to their Hafts;* Dexter Pierce, Montague, Franklin county, Massachusetts, August 13.

The claim made is to the "enclosing and attaching, between two cylindric pieces of metals, awls of various kinds; of securing or staying the same to their hafts, and of elevating or depressing the points of sewing awls, as set forth in the specification and drawings."

There have been several patents for various modes of adapting a number of awls to one common handle, and that before us, will, most probably, not be the last; we cannot take the time and space necessary to point out the

differences in such an affair, where we see little more than a variation in the means employed, without any substantial improvement.

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22. For a *Gravel Pump;* Laura Rice, Administratrix of J. J. Rice, and Ebenezer Rice, Salina, New York, August 15.

"This pump, or machine, is inserted in a well, or shaft, which should be properly tubed with cast or sheet iron, or other proper material, with space to permit it to pass readily, and having a rope, or cords, connected with the end of the piston, is worked in the manner of a pump until sufficiently charged with the substance to be removed, when it is raised by a windlass, or other power. It is particularly adapted to the excavations of shafts for brine, and was discovered whilst excavating wells for that purpose, as no instrument was known which would readily raise the gravel from the beds without great delay and difficulty, and at the same time leave the sides of the well bare and pervious to the transmission of brine, the ordinary process of drilling merely crowding the staves from the shaft, and rendering the sides of the well compact, hard, and nearly excluding the passage of small streams of brine into the well."

The form of the exterior of the machine is that of two cylinders differing in size, the smaller standing above the larger; the lower cylinder is to be about 11 or 12 inches in diameter, and twenty-one in height; the upper one may be eight inches and a half in diameter, and fifteen in height; they are connected by an offset, are hollow, and made of cast iron; the upper cylinder forms a pump chamber in which a piston is to work. The lower cylinder constitutes a receiver to retain the sand and gravel drawn into it by the action of the pump. In the bottom of the lower cylinder there is a round opening of six inches in diameter, and the upper and inner edge of this opening is surrounded by pieces of whalebone, or other elastic material, which rise from it so as to form a cone somewhat like that of the pointed converging wires in some rat traps; these may be six or seven inches long. They allow of the passage of stones and gravel into the chamber, and prevent their return. This elastic material is surrounded by a sleeve of cloth, which admits sand to pass up and around it.

The claim is to "the manner of connecting and combining the respective parts of the above described machine, for the purpose of excavating wells and shafts, and the removal of sand and gravel therefrom; that is to say, the combination of the exhausting apparatus with the cylinder, the conical bars of whalebone or other material, and the canvas surrounding the same, constructed and operating in the manner set forth."

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23. For an improvement in the *Power Loom;* William B. Bender and Nathaniel C. Horn, Wolfsborough, Stafford county, New Hampshire, August 15.

"The improvement consists in a new method of raising the harness of the loom," which are said to be "more simple, and easier of being raised to suit different figures or fabrics to be woven, than those heretofore known and used." What is called a "working frame," is elevated above the harness by two standards; this is operated upon by motion communicated from the shaft, but the arrangement of its parts cannot be readily described in words. The claim is to "the working frame with the spring bed, in combination with the horizontal levers and vertical arms; and in combination therewith the cylinder and arms for moving the arms and levers, and causing an alternating motion of the levers for raising the harness, as described."

24. For a *Machine for Crimping Leather for Boots;* Nathaniel Woodbury, Calais, Washington county, Maine, August 16.

The leather is to be forced on to a former, made in a manner so similar to that employed in several other machines, as to deprive this of all claim to novelty in its general construction, and the patent, therefore, is confined to the manner of constructing a bevel block, and the arrangement of two levers, which will probably do the work as well as it can be done in the various ways previously patented.

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25. For a *Mill for grinding or bruising flaxseed and other substances;* George L. Stearns, Boston, Massachusetts, August 17.

The seeds are to be bruised, or ground, by two or more pairs of metallic rollers, said pairs of rollers being placed immediately over each other, so that the seed which passes between the upper, shall fall upon the lower pair. The rollers of each pair are to be unequal in size, that they may produce a rubbing effect on the seed. The claim is to "the mode of grinding flaxseed, or other substances that may be reduced therein, by cylinders or rollers, constructed, placed, and operated as above described."

Rollers have been used for bruising and grinding seeds, and they have been made to run with different velocities, but possibly not with two or more pairs in succession, as by the present patentee; in this, therefore, consists the only novelty, if novelty there be.

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26. For an improvement in *Saw Mills;* Cornelius Van Alstine, Manlius Centre, Onondaga county, New York, August 18.

In this mill, the side timbers of the saw frame are to extend considerably below the lower cross-piece, so that a crank shaft, furnished with two cranks, may pass through them, the side pieces serving the purpose of pitmen. The crank is to have but a small throw out, say an inch, or upwards. The timbers of the frame are also to extend up above the saw, and are to have jointed bars running horizontally behind them, these bars being connected by joint pins to the said frame, at one end, and to the framing of the mill at the other. The patentee says that this "will enable sawing to be performed with a short crank, by the help of the guide arms to the upper end of the saw gate, and the saw will clear itself by repeatedly drawing down the sawdust, even with an inch crank only." The claim is to "the application of the crank to the bottom of the side pieces of the saw gate, in combination with the guide arms, the whole constructed and operating substantially as herein described." The averment made may be very true, but we confess ourselves unable to discover from what source any advantage is derived from the proposed arrangement.

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27. For a mode of *Heating Buildings, and Evaporating Fluids;* Angier M. Perkins, a citizen of the United States, residing in London, August 20th.

The specification of this patent is published in vol. x., p. 45, of this Journal, a patent having been obtained in England in the year 1831, but the grant was accidentally delayed in the United States, and it was at length issued under a special act of Congress, passed for that purpose. The plan has been extensively carried into effect in Great Britain, the British Museum, and a number of other public, as well as private, buildings, having been heated upon the principle patented. It has also been essayed in New

York, and the published reports speak highly in its favour. Mr. A. M. Perkins is the son of the well known Jacob Perkins, Engineer.

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28. For an improved mode of constructing Metal *Bench Vices;* Thomas and James Keane, Haverstraw, Rockland county, New York, August 20.

This is a very ingenious, simple, and, we believe, perfectly novel mode of constructing bench vices. The instrument can be made as cheap as the ordinary vice, and, we suppose, even cheaper. The screw is a short one, and there is no screw box passing through the vice below the jaws, this part being made of a solid bar of iron, and the end of the screw pressing against the front of the fore jaw, in the part where the ordinary screw enters it.

A quadrangular frame of metal is made, of an oblong form, the space between the two sides embracing the legs of the vice below the jaws, and through one end of this frame passes the short screw by which the jaws are to be closed. Behind the vice, in the situation usually occupied by the screw box, there is a piece of iron formed into steps, so as to constitute a ratchet upon which the back end of the frame may catch. The jaws are forced apart by a spring in the usual way, and when any article is placed between them, the hand is pressed against the fore jaw, and the back end of the frame catches upon one of the steps of the ratchet, when by a turn or two of the screw the article will be firmly held. The claim is to the manner of constructing vices, in accordance with the foregoing description.

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29. For a *Smut Machine for cleaning Grain;* John Parker, Sunbury, Delaware County, Ohio, August 23.

In this machine the grain is conducted from a hopper into a vertical, hollow cylinder, toothed on the inside, and within which are revolving arms, or wings, moving rapidly, so as to beat the grain backward and forward with great force. The claim made is to "the peculiar form of the curved punched wings, fastened to the shaft, revolving within the centre of the cylinder, that is to say, in having the side of each wing which is fastened to the shaft made straight, and then curved backward from the shaft to its outer extremity, and braced by arms radiating from the shaft, to the ends of which the curved wings are fastened, as herein described."

Those who are acquainted with the construction of the different smut machines now in use, will perceive that there is but little that is new in that before us; when examined in the patent office, it was, of course, supposed to possess sufficient novelty to entitle it to a patent; we should not, however, impeach the judgment of a juror who should pronounce it substantially the same with some of its predecessors.

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30. For a machine for *Moulding Bricks;* John Bolton, Saratoga Springs, New York, August 23.

The moulds into which the bricks are to be pressed, are placed in sets, one behind the other, upon a rectangular frame, which is to be made to pass horizontally, by means of racks and pinions, under the hopper containing the prepared clay; in the drawing, each set is a box of five moulds, and there are five such upon the frame. The back part of the hopper is, in part, formed of what is called a forcer, which may be brought down upon the tempered clay, like a box lid, so as to force it through the grating which

constitutes the bottom of the hopper, into the moulds below. The forcer is made to descend, or rise, by means of a segment rack and pinions. The horizontal frame is to be moved on until all the moulds are filled. In case of obstruction from stones, the frame, under the hopper, may be lowered by turning a shaft carrying an eccentric roller, or two eccentric wheels, which support the frame. The claim is to the forcer, and the eccentric roller, or wheels, combined and operating as above described.

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31. For a *Smut machine for cleaning Rice, Wheat, and other Grain;* Daniel H. Southwork, Little Falls, Herkimer county, New York, August 23.

In its general form and mode of operation, this machine resembles several others. It has an outside shell composed of staves of cast iron, within which revolves a conical apparatus of beaters and rubbers, which are to operate upon the grain. The claims are confined to the particular construction and arrangement of the parts constituting the rubbing and beating surfaces. The terms of the claim do not afford any correct idea of the form of these parts, nor can they be readily explained without the drawing.

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32. For a machine for *Thrashing and Cleaning Clover Seed;* William Rowe, Frederick, Frederick county, Maryland, August 25.

We are informed that "the distinguishing feature of this machine consists in a very simple combination and arrangement of an apparatus for thrashing out the seed from the hulls. A circular revolving screen into which the seed and chaff are delivered for separating the one from the other, a revolving fan for cleaning the seed, a vibrating screen placed below the revolving screen for more perfectly cleaning the seed, and an endless movable apron, or conveyor, for conveying the seed to any place desired." So far as this general description goes, the respective parts do not present any thing of novelty, the whole of them having been before used for a similar purpose; it is only to the peculiar manner of connecting and operating these parts, therefore, that a claim can be made, and this it is not necessary to give, as it refers to the description for its illustration.

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33. For improved *Machinery for Raising Heavy Bodies;* George Kilburn, Walpole, New Hampshire, August 23.

This is, apparently, a well arranged machine; the particular intention of it is not mentioned, but it is to answer purposes similar to those effected by jack screws, and it is stated that it may be used as a press by placing a follower on its upper end. The power is applied through the intervention of two toggle joints, or progressive levers, the lower ends of which rest on the base, or foundation of the machine, and their upper ends are sustained by a frame which carries palls that take into ratchet teeth on a vertical shaft which slides up in the middle of the apparatus, the distance gained being kept by palls taking into ratchets at the lower end of the vertical shaft. The toggle joints are made to vibrate by means of a shaft crossing the machine horizontally, and carrying pitmen, or connecting rods, to the toggle joints. On one end of this horizontal shaft is hung a pendulous, weighted rod, which is to be swung backward and forward. The claims made are to the special arrangements above indicated, and to some others which we have not noticed.

34. For apparatus for *Preventing Cattle from getting on Rail Roads;* David Green, Greenfield, Saratoga county, N. York, August 25.

This is a device which will never be used, as every competent engineer would at once pronounce its death warrant; a gate is to cross a rail-road track, and the cars, or locomotive, is to bear upon certain lever rails, placed along the ordinary track rails; by means of which, said gate is to be opened; there is an array of levers, pulleys, and weights, which are to be called into action, and woe betide the gate should any one of these be out of order. The idea of keeping cattle from a rail road, by a gate crossing it, has the merit of singularity, as but few men would conceive it to be of any use in long continued lines of unenclosed woods, waste grounds, and a hundred crossing roads and paths, with which our roads are plentifully furnished.

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35. For a *Cooking Stove;* Simeon Heywood and L. P. Fisher, Claremont, Sullivan county, New Hampshire, August 29.

"The invention claimed, and desired to be secured by letters patent, consists in the particular manner in which the flues are arranged and combined, at the back of the oven;" and in the almost infinite variety of stoves which are made the subject of patents, a large proportion of them present nothing of novelty beyond some slight alteration in the manner of arranging the flues, from which their projectors, it is true, anticipate very important results, but which are rarely known after the lapse of two or three years.

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36. For an improvement in the *Machine for boring Rocks;* George C. Doherty, Cumberland county, Kentucky, August 29.

This is a device for giving to the shaft which carries the drill, or boring tool, the necessary motion by the application of animal power. The claim is to the manner of connecting the shaft of the auger with a lever, treadle, and pitman, so as to produce the desired effect; there is not any thing in the particular arrangement of these parts which appears likely to accomplish the proposed end any better than that of many others which might claim an equal share of originality.

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37. For an *Endless Chain Horse Power;* Amos Parker, Windham, Cumberland county, Maine, August 30.

The endless chain of slats is to be supported upon friction wheels, which run upon a wedge-formed railway, the ends of which railway are rounded to allow of the passing of the friction wheels round them. There is some slight peculiarity in this arrangement, but nothing to render it superior to others, or to merit any detailed description.

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38. For an improvement in the *Platform Balance, for Weighing;* John D. Dale, Lansingburgh, New York, August 30.

The patentee states that the principal improvement in relation to platform scales, or balances, "consists in having two beams to one scale, differently graduated; as one by a division by tens, fifties, hundreds, or the like; and the other to units, or the fractional parts of a unit, with a sliding weight or poise to each; and either connecting the beams with each other on the principle of a double lever, or as a beam having one fulcrum, with two bars for its longest arm, running parallel to each other, and united by a cross-bar at each end," &c. &c. After representing the respective modifications referred to, the claims are made to "the combination of two steel-

yards, as described, the manner of constructing the lower lever and friction rollers; the sliding weights in manner, and for the purposes described; the making the sliding weight with a nonies, dividing it into fractional parts; the arrangement of the levers by which the platform is connected with the scale beam." There is, undoubtedly, novelty sufficient in the particular arrangements referred to, to justify the grant of a patent, but we really cannot find any thing in this novel arrangement of certain parts which renders the apparatus more accurate, or more convenient, than some others before in use.

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39. For a machine for *Sawing Clapboards;* Crawford Tyler, Millford, Hillsborough county, Maine, August 30.

The clapboards are to be cut by a circular saw from quartered timber, rived into bolts of suitable length. The round side of the quartered timber is sustained upon the carriage by means of two hollowed, or curved head blocks, in such a position as that when not held by the dogs it will slide down upon the head blocks, against two stops, which determine the thickness of the thick edge of the clapboard; it is then seized by dogs upon the carriage, and forced up by hand against the revolving circular saw. The claim is to the manner in which the dogs are constructed and operated, in combination with the stanchions, or curved head blocks, stops," &c. This machine is simple, ingenious, and, we doubt not, fully answers the purpose intended.

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40. For a *Marine Railway:* Robert W. Tindle, Administrator of Israel Riggin, Baltimore, Maryland, August 30.

This railway is intended to receive two vessels at once, so that both may be under repair at the same time, whilst one may be launched without disturbing the other. From the description and representation given, the apparatus appears to be adapted to small vessels only; the matter, however, is not made very clear, and we are not disposed to devote much time to the study of it. To give the claim would be useless.

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41. For a *Vertical Tooth Extractor;* David H. Dickey, Boston, Massachusetts, August 30.

We have not yet found a vertical tooth extractor which we have thought worth using, excepting it be a good pair of forceps, a strong wrist, a stout grip, and a well managed thumb for a bearing. We have seen many vertical tooth extractors, some made abroad, and a number patented here, from the time of Bruff's, upwards of forty years ago, to the present day; we have owned some, have drawn many teeth, but never with a vertical extractor, because we have not liked them, and the new acquaintance now introduced to us has not insinuated itself into our good graces, as it appears to possess the common faults of the family, faults which we think are inherent, and, therefore, have little for hope to act upon.

In the instrument before us, the tooth is to be embraced between two claws, working on a joint; these claws are kept open by means of two springs, acting between them, and are made to take hold of the tooth by means of a pointed shaft, or circular wedge, the end of which is forced, by means of a screw, in between the heads of the claws, above the joint pin. A plate of metal, perforated to admit the claws and the tooth to pass through it, is to lie upon the teeth contiguous to that to be drawn, and a

lever connected with this plate by a hinge joint, is depressed in order to raise the tooth. Now it so happens, and must happen until the laws of nature are changed, that action and reaction are always equal, and in contrary directions, and by the operation of this law the contiguous teeth will be subjected to as much force inward as will be exerted upon the extracted tooth to draw it out; and it will so happen that the whole of this force will be exerted upon two teeth only; this is the objection to such instruments in common, and is not the only one, although we deem it sufficient.

The claims are, "1st. The lever (qr. shaft) working in a female screw, with one end pointed, and forming a revolving wedge for opening the upper parts of the forceps, thereby contracting the lower, or that part which is made to adhere to the tooth, in combination with the other parts of the instrument, as described. 2nd. The springs which act on the inside of the forceps for opening the lower part when the revolving wedge is removed, in combination with the lever, as set forth. 3rd. The peculiar arrangement of the different parts of the instrument, substantially as described and set forth."

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42. For a machine for *Turning Tree-Nails, Bannisters, Rake Handles, and other cylindrical articles:* Joseph E. Andrews, Boston, Massachusetts, August 30.

The tree-nail, or other article, is to be formed by placing it in a common collar and mandrel lathe, in the ordinary manner, and it is to be turned by means of a sliding head, the upper end of which is a hollow, or tubular box, containing cutters for roughing and smoothing the article to be turned, which article passes through the tubular box, the sliding head being forced by hand from the mandrel to the front centre. The claim is to "a cylinder or other properly shaped body, with screws and cutters constructed and operating as described, for the purpose herein above mentioned."

The only difference between this instrument and such as we have seen in use, and used in days of yore, is that the cutting head or box, with its cutters, was, in the latter, held in the hands, and passed along the piece to be rendered cylindrical, instead of being on a sliding head, passing along the shears of the lathe. Such a tool, we apprehend, has had many hundred inventors, and been used by many thousands of workmen.

Specifications of American Patents.

Specification of a Patent for an Elastic Adhesive Compound for Binding Books; granted to David Felt, *City of New York, August 1st,* 1838.

The nature of my invention consists of an elastic, adhesive compound for attaching the leaves of books together, which entirely obviates the necessity of sewing. The following is the method of preparing said elastic, adhesive compound.

Take eight parts of isinglass, two parts of gum arabic, and after soaking them in a little rain water until they become soft, add four parts of pure honey, then dissolve the whole with alcohol over a slow fire.

Mode of application. The section or folds of the book are first made in the usual manner of one sheet, and carefully pressed and knocked up on the back, and cut on the front. The back is then put into a curved mould to give it a proper form. It is then put between two cutting or press

boards, and placed in a press and screwed up; after which the back is made rough, and the elastic adhesive compound applied with a stiff brush, and then left to dry; when dry, or nearly so, another coat is put on, so as to form a sufficient body. Some cotton or other flexible cloth is then prepared, with two coats of the compound; a strip of this cloth is then put quite over the back, extending down on each side about two inches, and after rubbing it well on the back to make it adhere, and leaving it a short time to dry, it will be ready for binding in the usual way.

When books are printed and folded in sections of more than one sheet (qr. two leaves) to a fold, the back is cut off and the process continued as heretofore described.

This compound may also be used as a substitute for glue when books are sewed and stitched in the usual way.

The discovery claimed, and desired to be secured by letters patent, is the elastic adhesive compound above described, for binding books.

DAVID FELT.

Remarks by the Editor.—The foregoing compound is intended to be used as a substitute for the solution of gum-elastic claimed in the patent of Mr. Hancock. vol. xxii., p. 86, and previously essayed by Mr. Breed (vol. xxiii, p. 67.) The objection to this substitute is that it will be equally liable with common glue to be effected by dampness, an objection to which the gum-elastic will not be liable. We doubt, however, the equality of the gum-elastic binding to the common process; we have seen some of the books bound under the direction of Mr. Breed, and have found that a single leaf may be easily detached; this, it is true, may arise from the imperfectness of a first essay, but we should be unwilling to subject valuable books to the trial. As respects the recipe given by Mr. Felt, and claimed as new, we much doubt the validity of this claim, as a compound of glue, gum arabic, and sugar, is not new. The alcohol is not a solvent of the fish glue and gum, and is of no other use in the compound than to prevent its putrifaction. Whiskey, or other ardent spirits, will answer the intention equally well.

Specification of a Patent for an improvement in the mode of dressing and finishing leather; granted to ADAM HICKMAN *and* EDWIN L. DAVENPORT, *Abingdon, Washington County, Virginia, August 1st,* 1838.

The practice of finishing and dressing upper leather as at present used, is, when it is drawn from the vat, whilst wet, it is shaved, then oiled on the grain side, the grain then turned and the flesh set down with a *slecker*, then stuffed out. This is a process known to curriers as that of covering the flesh side with a composition of oil and tallow. It is then hung up to dry, and when fully dry, taken down, beaten on a pin block, then boarded up, and the flesh set down with a stone instrument. These last operations are necessary to fit the leather for whitening, or dry shaving, to remove the coating of oil and tallow so that the leather may be prepared to receive the blacking.

Our mode is this, when the leather is taken from the vat, wet, shaved, oiled on the grain side, and the flesh set down in the usual manner, it is then simply oiled on the flesh side, dried, pin blocked, boarded, and trimmed, and is then ready for blacking.

By this mode there is a considerable saving of labour; it excludes boarding up once, and leaves the whole tedious routine and very laborious opera-

tion of dry shaving, or, as it is commonly called, whitening, well known to all curriers as making a large amount of the labour sustained in fitting up leather for the market. The shoulder and flank are kept much thicker; this is a matter of great importance, as the whitening, &c. cannot be done without reducing the thickness of the leather, and otherwise impairing its quality where it is already deficient.

What we claim as our discovery, and desire to secure by letters patent, is the saving the labour of once whitening, boarding, and stoning in all kinds of upper leather, also avoiding the use of tallow, and simply using oil in its stead.

ADAM HICKMAN.
EDWIN L. DAVENPORT.

Specification of a patent for a new mode of protecting Bank Notes, Bills of Credit, &c., from alteration; granted to EBENEZER WATSON, *city of Albany, New York, August* 3, 1838.

To all whom it may concern: Be it known, that I, Ebenezer Watson, of the city of Albany, in the state of New York, have invented a new mode of protection against the alteration of Bank Notes, Bills of Credit, Circulating Notes, Certificates of Stock, and other instruments of writing, by any change of the sum thereof; and I do declare that the following is a full and exact description.

The nature of my invention consists in engraving, printing, or otherwise expressing, the sum in large letters, words, or figures, on the face of the note, &c., and so disposing the words, or other matter, of the body of the note, &c., as therewith to fill up the spaces between such large letters, words, or figures, and between the parts thereof, but not to cover such letters, words, or figures, or the parts thereof, either in whole or in part.

EBENEZER WATSON.

Specification of a patent for an improved mode of manufacturing Ploughs of Cast Iron; granted to CYRUS ALGER, *city of Boston, Massachusetts, August* 3, 1839.

To all whom it may concern: Be it known, that I, Cyrus Alger, of the city of Boston, in the state of Massachusetts, have invented a new and improved mode of manufacturing Ploughs; which improvement is applicable to all the various kinds and forms of Ploughs which are made of Cast Iron, and I do hereby declare that the following is a full and exact description thereof.

The nature of my invention consists in the giving to the iron work of the whole body of the Plough, consisting of the mould board, land-side, share, movable, or permanent points, and other parts requiring it, that malleability which allows of their being altered in shape, in the same way in which wrought iron may be altered, and at the same time giving to all the cutting edges, and to such other parts as from their exposure to wear may require it, the necessary degree of hardness and temper, and the capability of being softened, drawn out, and again hardened and tempered, whenever it may be desired.

I cast the respective parts of the plough to be made, of iron, from any of the known patterns, and I then subject these parts to the well known process of annealing, by which cast iron is rendered malleable; having carried

this process to the necessary extent, by which the iron is brought into that state in which it is susceptible of being hardened and tempered like steel. I then harden such of the cutting edges, and other operating parts, as may require it, and temper the same, in the manner in which steel is ordinarily hardened and tempered. I thus obtain a plough which, whilst it can be manufactured at but little cost, will possess all the useful properties of a plough the body of which is made of wrought iron, and its cutting edges and points, and such other parts as are most subject to wear, laid with steel.

Whilst I lay no claim whatever to the process of rendering cast iron malleable, or to any improvement in the general form or construction of the plough, I do claim the manufacture of ploughs from malleable cast iron, with such parts as may require it hardened and tempered, as steel is hardened and tempered; such being to the best of my knowledge and belief, an entirely new manufacture, producing results which are highly beneficial, and not heretofore produced by analogous means. CYRUS ALGER.

Specification of a patent for Generating Steam by bringing water into contact with hot or boiling oil, or grease; granted to HORATIO HUBBELL, *city of Philadelphia, August* 6, 1839.

The nature of my improvement or invention consists in applying to steam engines a mode of instantaneously generating steam by bringing water of the common temperature into contact with hot or boiling oil, or hot or boiling grease; the steam so generated to be applied as the moving power of the steam engine. The words "common temperature" are used as aforesaid, because water of that temperature is the kind proposed to be used, is fully adequate to the effects designed, and is most economical; but at the same time the effect can be produced as long as the water is inferior in temperature to oil, the oil being heated above the boiling point of water, or up to that point. The boiling point of oil or grease being above that of water, or, *vice versa*, that of water being below that of oil or grease, by bringing water in contact with oil or grease heated above the boiling point of water, steam is instantaneously generated. The point to which the oil or grease is intended to be kept heated is at, or near, the boiling point of oil, since the hotter the oil the more rapid and complete the action upon the water. The oil (whale oil is perhaps most convenient and best,) is to be introduced into copper, brass, or other suitable steam tight metallic cylinders, boilers, generators, or vessels. The quantity of oil to be introduced is to be regulated by the capacity of the cylinders, &c., the bottom of which it ought to cover to some depth, so as to have a good body of oil; generally, filling about a fourth of the cylinder, &c., will be sufficient, though there may be more. The oil may be introduced into the cylinder by means of a stop cock with a funnel head, the cock being placed or inserted at the side of the cylinder, so as to be on a level with the upper surface of the oil. The oil so introduced having been heated above the boiling point of water by a fire conveniently applied to said cylinder, boiler, generator, or other suitable vessel, so as to gradually fall upon the surface of the oil, or so as to come into contact with the oil at or beneath its surface. The reservoir here spoken of, is intended, in general, to be a large basin placed on a level with the top of the cylinder, &c., the pipe passing from the basin to the cylinder.

The said pipe or pipes to let water into the cylinder are to be provided with one or more valves, shutting outwards, so as to prevent the steam after

it is generated, from escaping through them, while by opening inwards they admit the water. The bore or caliber of the pipe or pipes may be so contracted as to let the water into the oil continuously, but very slowly and gradually, or the pipe being more free in its bore may have its water let into the oil, or shut out, by means of a cock constructed so as to open and shut at alternate intervals, by means of an eccentric, and the working of the engine; or the said pipe or pipes may be connected with pumps such as are now used to force the water into common boilers; but still care must be taken so to construct them as to introduce the water gradually, and by measure, to the hot or boiling oil, as is done in the former cases. The quantity of water to be let into the hot or boiling oil is to be regulated by the quantity of oil employed, and the extent of its surface, and the necessity of generating a greater or less quantity of steam, care being always taken not to drown the oil by throwing in too profuse a quantity of water upon it, and thereby produce a dangerous explosion. The pipes aforesaid may pass directly through the sides of the cylinder, &c., to the oil, or entering at the top may be carried down from the top of the cylinder, &c., along the inside of the cylinder till it reaches the oil.

The heat of the oil in the cylinder may be ascertained and regulated by the application of the thermometer, to a hollow, bulbed, or funnel-headed stop cock inserted in the side of the generating vessel, so as to let a quantity of the heated oil pass out at any time into the funnel head; this cock may be also used for introducing the oil. The oil may be drawn off from the generating vessel by means of a stop cock inserted in the bottom.

As the steam is thus generated, it is applied to, and let off from, a piston working in a steam tight cylinder by means of the sliding valve worked by an eccentric, as is now done in high pressure steam engines.

In the foregoing specification, I claim as my own invention and discovery, the application to the steam engine, of the mode of instantaneously generating steam by bringing water of the common temperature in contact with hot or boiling oil, or hot or boiling grease. HORATIO HUBBELL.

Remarks by the Editor.—We have not inserted the foregoing specification with the expectation of making known a valuable improvement in the generating of steam, but as a sample of those hypothetical contrivances which are not unfrequently made the subjects of patents by persons of speculative ingenuity, but who are not under the guidance either of correct theoretical knowledge of, or of a practical acquaintance with, the subject upon which they speculate; the possession of either of these would, we are well assured, have arrested the foregoing. We are not informed by the patentee what benefit he anticipates from his invention; it certainly could not have been security from explosion, where water and boiling oil are to be brought into contact, and where it is proposed to introduce the former under the surface of the latter. If the inventor had manipulated with boiling oil, he would have been aware of the danger arising from the contact of water with it. It would be scarcely possible to find two substances more ready to quarrel together, and to become involved in a dangerous broil, if brought into intimate connexion; besides, were there no danger resulting from their contact, oil would be one of the least suitable articles that could be chosen for transferring its heat rapidly to water, as it is a bad conductor of heat, while such a transfer would require a very good one. In case of fire, and but few articles are better calculated to produce this than boiling oil, the whole contents of the boiler would administer, most energetically, to its

destructive effects; gunpowder would be something worse, but not a great deal.

The specification is throughout extremely indefinite, every thing in it, except the using of heated oil or grease, being contingent, and no one practical mode of carrying the matter into operation being presented; in the present case, this is a thing of little importance, as the plan never will be adopted by any sane engineer, and the fact is mentioned merely to remind applicants for patents, of the necessity, in all cases, of presenting their inventions in such a form as shall enable any skilful workmen to carry the plan into operation.

Specification of a Patent for an improvement in the mode of preserving timber; granted to SAMUEL RINGGOLD *of Florida, and* EDWARD EARLE, *of Savannah, in the State of Georgia, August 6th*, 1838.

The nature of our invention consists in applying heat, by boiling in strong lime water, to the interior as well as to the exterior of timber, according to the size and kind of timber, and the use in which it is to be employed may admit, or require, for the destruction and prevention of worms in it, and for the correction or removal of the corruptible sap, and the occupation of its place by a preservative substance.

We first bore the timber, if it be of a size sufficient to admit of it, through the centre, making the perforation of a caliber proportioned to the size of the piece, say from half an inch to an inch and a half, or two inches. Then we boil it in strong lime water for a length of time proportioned to its size, as four to six hours, if it be twelve inches square, and so in proportion to its substance; and when the timber has had the heat and fluid conveyed through its whole substance, it is to be removed to a shed, where, protected from the sun and wind, it may gradually dry. Finally, before it is used, the perforation through the centre is to be completely filled with dry lime, or with petroleum, or coal tar, as the purpose for which it is intended may make preferable, and plugged by wood of the same kind, and prepared in the same manner. Also, if the use to which the timber is destined be such as to admit of it, the exterior may be payed, or coated with hot petroleum, or coal tar.

What we claim as our invention, and desire to secure by letters patent, is the boiling of timber in lime water, as above set forth. We apply the fluid to the interior as well as exterior of the timber, by means of the central perforation, when the size of the timber requires it, as the most effectual mode of preserving it from the ravages of insects, and from rot. We do not claim the saturating of timber by a solution of lime in water when applied cold, or when heated by that heat which is generated in the slacking of the lime, but confine our claim to the boiling it in lime water during one, two, three, or more hours.

SAMUEL RINGGOLD.
EDWARD EARLE.

Remarks by the Editor.—The plan of impregnating timber with lime, by soaking it in lime water is quite old, but we have never yet seen any evidence of its utility. This is an assumed effect, but one which, we believe, yet remains to be proved. The only substantial difference in the plan above proposed, and that formerly essayed, is in the boiling process, and this we think of very doubtful utility. Timber may be rapidly seasoned by boiling, the moisture within it being converted into vapour, and consequently es-

caping through the pores, a condition not the most favourable to the entrance of a solution; the allowing it to cool in and with the liquor might probably promote saturation. There is another fact of some importance in the process, provided the thing itself is of any value, namely, that the colder the water the greater is the quantity of lime held in solution, and of course more would enter the pores in a cold than in a heated vessel. It is not worth while, however, to extend our speculations upon the best mode of getting the lime in until we have ascertained the fact that when it is there it will produce some good result.

Specification of a Patent for preparing the Lignia, or fibrous portion of Corn Husks, so as to be a suitable base for Paper, and oxalic acid; granted to Homer Holland, Westfield, Hampden County, Massachusetts, August 13th, 1838.

The corn husk consists of two distinct substances, viz: lignia, and mucilage. The lignia, or fibrous portion, is similar to the fibrous portion of hemp or flax, and must be completely freed from the mucilage before it can be bleached. By making it susceptible of perfect bleaching, without destroying the strength of the fibre, it may be used for valuable purposes.

The nature of my invention consists in making the mucilaginous portion of the husks soft and soluble by means of alkaline solutions, so as to be readily removed by washing and beating, leaving the fibre strong and capable of being perfectly bleached.

I adopt the following method of applying the alkaline solutions. The husks, properly selected and cleaned, are to be macerated for several hours in a moderate solution of carbonated alkali, in any convenient kettle, caldron, tub, or vat, which may be kept warm by fuel or steam. After having been thus macerated, sufficient of hydrate of lime is to be added to combine with the carbonic acid of the alkali, and render it caustic, so as to dissolve the mucilage, and the whole is to be boiled from one to two hours. The mucilage of the husk is thus converted into a soluble umate of the alkalies employed, and in this state may be removed from the lignia or fibre, by washing in several waters, rubbing, and scouring. If the husk be thus treated the lignia is strong, and if the washing, beating, and scouring be suitable, the fibre may be completely separated, and may be perfectly bleached by an alkaline chloride, or sesqui-chloride, in solution, or by any of the known and appropriate processes of bleaching. The lignia or fibre thus prepared may be used as a substitute for sugar or starch in making oxalic acid, and after being rendered even, if necessary, by rolling or pressing, may be manufactured into paper in the same manner as the ordinary fibre from rags.

What I claim and desire to secure by letters patent, is the process of macerating the husks of corn for several hours in a solution of a carbonated alkali, and then rendering the alkali caustic by adding the hydrate of lime, and boiling for one or two hours, as above described, in order to produce a strong and bleachable lignia, or fibre, for the manufacture of paper, of oxalic acid, and for other purposes. HOMER HOLLAND.

Remarks by the Editor.—The only novelty in the process above described, is that of rendering the alkali caustic, by the application of quick lime, after the husks have been macerated; the other steps have all been taken in the manufacturing of paper from straw, and other materials; to what extent

this part of the process is of utility is a practical question, concerning which we are not informed; all we know respecting it is, that it is in the hands of a gentleman of much skill and experience, and who had, therefore, undoubtedly satisfied himself of the utility of the plan before presenting it for a patent.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a patent granted to FREDERICK JOSEPH BURNETT, *of the city of London, and* HIPPOLYTE FRANCOIS MARQUIS DE BOUFFET MONTAUBAN, *of Chelsea, in the county of Middlesex, for certain improvements in the manufacture of Soap, being a communication from a foreigner residing abroad. Sealed 4th July*, 1838.

The object of this invention is to make or manufacture soap from refuse animal matters, which have not hitherto been used for such purpose, whereby such matters which have heretofore been thrown aside for manure, or put to little use, are made available to a better and more useful purpose; and consists in making or manufacturing soap from the intestines of animals and other gelatinous or fibrinous parts of animals, and also of fish, which have not before been used for such purposes. Such intestines or other gelatinous or fibrinous materials being subject to processes whereby caustic alkali is made to act upon the said materials, and produce saponification, and convert the same into soap.

And previously to describing the mode, manner, or method and processes of treating or operating upon such refuse animal substances, we will first state that we are well aware that all animal and vegetable oily and fatty materials have long been employed in the manufacture of soap; and also, that caustic alkali has been used in such manufacture, for producing saponification, and converting the said fatty materials into soap; and, therefore, we hereby disclaim the use of all fatty or oily matters extracted from animal or vegetable bodies in the process of manufacturing soap, saving and except when used in conjunction with the refuse animal, gelatinous, and fibrinous materials, as hereinafter described; that is to say, when such animal or vegetable fatty matters are used in small proportions, mixed with the said refuse animal matter after being acted upon by the alkali, for the purpose of producing a better quality of soap than the said refuse animal matters would make when used by themselves.

And we will now proceed to describe the process, manner, or method of treating the said animal, gelatinous, or fibrinous matters, and converting the same into soap, stating the process which we have employed, and found to answer well for this purpose when treating upon the intestines of animals. That is to say, the intestines, after being well washed or cleansed, are placed in proper vessels, and immersed in a ley of caustic soda or alkali, in order to prevent their decomposition until they are wanted for use. The quantity of this ley, in proportion to the mass of intestines, must vary according to circumstances; we have found seven or eight per cent. of alkali, to the quantity of materials under operation, to answer well. The animal matters are to remain in the tubs or vessels seven or eight days, or until the alkaline solution is absorbed, and a partial saponification has commenced. When the intestines are required for use, they are to be carefully washed, and well drained or partially dried on hurdles or nets, after the manner

that feltmongers treat their materials; after which, the animal matters are to be placed in a copper or other suitable vessel containing a solution of caustic alkali. This caustic ley is to be made warm during the time required to produce the entire saponification of the materials: the fire used in this operation or process should be slow, if applied direct to the copper or other vessel, as the materials ought never to be allowed to boil. This is easily prevented, after a few trials have been made and the proper precautions used, which practice will show; but if the copper or other vessel containing the materials is heated by means of steam or hot water, in the way it is commonly applied in various operations and manufactures, then these precautions will not be required, as the alkaline ley will never boil if the apparatus is properly arranged and constructed. After the saponification has taken place, the soap is to be poured into moulds to give the required shape of the cakes, and allowed to cool, and, when hard, is ready for use.

We should here observe, that this soap contains, in its primitive matters, a large proportion of water, and, therefore, dries with greater difficulty than common soap. If it is desired to obtain a hard soap, it is necessary to add into the copper or other vessel, after a few hours of the above operations, a sufficient quantity of barras or gallipot, or other resinous matter, which will give it solidity. It is difficult to indicate or name the precise quantity of materials to be used in these processes, because the intestines have more or less fatty substances or materials commingled with them; but a few days' practice and experiments will show this better than any stated proportion. When it is wished to obtain a whiter soap, it is necessary, as soon as the saponification is finished (and no gallipot has been used), to mix in the copper a proper quantity of chloride of soda or other bleaching matter, the whole mass of materials being well agitated or stirred during a proper time, and the result will be as desired.

It is important to notice that the ley or solution of caustic alkali is incorporated with the animal matters, and therefore a superabundance of water cannot be drawn or pressed out of the materials after saponification, as is the case in the ordinary manufacture of soap from fatty materials; and we would further remark, that the saponification of the gelatinous or fibrinous matters is a rather delicate process, and, therefore, requires attention. The difference of temperature or climate, and the proportion of fatty matters which the intestines contain, ought to determine, in some degree, the proportion of alkali used, and the modification of the dose of the ley, all of which will be readily suggested by any practical soap manufacturer or chemist. We should here mention, that in order to introduce the barras or gallipot, or other resinous matters into the soap, it is necessary to dissolve it in the ley or alkaline solution, or in the fatty materials, to be afterwards incorporated with the soap when it is required to produce a better quality. We have named the above substances because they, being of a whitish hue, will give less colour to the soap than common rosin; but if the colour of the soap is not material, then rosin may be used to harden it.

Having now described the process and manner or method of operating and treating the refuse animal materials in producing the effect of this invention or discovery, we would remark that the same applies to all gelatinous and fibrinous animal matters not hitherto used in soap-making, the intestines, refuse pieces of skin, sinews, muscles, fleshy or fibrinous parts, horns, hoofs, all kinds of fish and gelatinous animal matters which cannot be put to a better purpose; the only difference of treatment being, that these

different matters will require different proportions of the alkaline solution and different periods of operation, all of which will be found by practice when treating these matters, as above described.

And, in conclusion, we would remark that the caustic alkali solution or ley above named, in both the first and second processes, may be formed with water and the common soda of commerce, pearl ashes, or barilla, caustic lime, or a mixture of all or some of these alkalies; therefore, we do not mean or intend to confine ourselves to alkali in any particular state, or to any particular proportion thereof, nor to any particular time the materials are to be kept under operation, as these must vary according to the quality of the materials to be operated upon: remarking that these processes, manner or methods of treating the above named gelatinous or fibrinous matters, do not, nor are they intended to apply to the making of soap from animal, fatty, or oily matters, as the same is not at all applicable to the making of soap from such materials alone; and when such fatty matters are added thereto, it is only to produce a soap of better quality or appearance than can be made by the gelatinous and fibrous matters alone.

And, finally, we would state, that what we claim under the above in part recited Letters Patent, is the making or manufacturing of soap with the above-mentioned refuse-animal, gelatinous, and fibrinous matters, by treating or operating upon them, and producing saponification therein by means of the caustic alkaline leys or solution, in the manner or method above set forth and described.

Lond. Jour. Arts & Sci.

Specification of a patent granted to EDWARD HEARD, *of the county of Middlesex, for his invention of certain improvements in oxydizing Lead, and converting the same into pigments, or white and red lead, and manufacturing part of the products arising from these processes into Soda. Sealed* 1*st August*, 1838.

The Patentee describes his invention in the following manner:—I take any known weight of lead and melt it in a reverberatory furnace: to the melted lead I add about half its weight of a salt called nitrate of soda, throwing in small quantities at a time, and stirring it well in order to mix it with the fused metal. When the whole of the salt is thus put into the furnace, it is kept continually stirred until the lead entirely loses its lustre and metallic appearance, which takes place by exposure to a low red heat, in the course of a few hours, and becomes converted into a protoxide of lead resembling, in colour, litharge.

When it has attained this state, the charge is withdrawn from the furnace and cast in moulds to consolidate, or spread on a clean stone floor to get cold.

It is next ground to a very fine powder, and if intended for the manufacture of white lead, it is put into a large vat close covered, and mixed with water to about the consistence of thick cream. Into this mass a current of carbonic acid gas is directed, and agitation kept up until the protoxide of lead is converted into carbonate of lead.

This should be well washed, and the saline solutions mixed together and evaporated to dryness. The salts thus obtained, consisting of a mixture of sub-carbonate and nitrate of soda, may be used again two or three times successively when thus recovered with fresh portions of lead, taking care

that the metal employed is about double the weight of the saline matter in each charge.

When the whole of the nitrate of soda is decomposed by these successive operations, it is lastly conveyed into an alkali furnace, and there finished with carbonaceous matter; the alkaline salt is then lixiviated, and the solutions mixed and evaporated to dryness, or brought to such a specific gravity as will, under proper circumstances, cause it to form crystals of carbonate of soda, according to the views of the operator: thus white lead and carbonate of soda are produced.

When the object is to manufacture *red lead*, the protoxide of lead above mentioned, as being produced by the first process of oxydation, when taken out of the furnace and cold, is ground fine and put into a vat, where it is repeatedly washed until all saline matter is separated; this latter being reserved for future operations: the protoxide of lead thus purified, is then removed into a red lead furnace, such as are in common use, and there finished in the usual manner. Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

A Statistical View of the recent Progress and present Amount of Mining Industry in France; drawn from the Official Reports of the "Direction Générale des Ponts et Chaussées et des Mines." By G. R. Porter, Esq. F. R. S.

(Concluded from p. 35.)

Iron.—At the present time France occupies the second rank among nations as regards the production of iron, England being still immeasurably in advance of France, in which country the extension of this branch of industry is far less than has been effected of late years with us.

There are at this time in France 12 distinct localities or districts, in which the making of iron is prosecuted. The processes employed for the conversion of the ore in these different sets or groups of iron-works differ materially from each other, in respect of the different kinds of fuel employed for the purpose. May it not be owing in a great measure to this circumstance, that improvements in the manufacture have hitherto made a very slow progress in that country? The improvement applicable to the process where one kind of fuel is used may be inapplicable to works where another kind of fuel is consumed, and it will therefore probably be confined to the spot in which it is originated. If the processes used for the conversion of the ore had been identical at first, it would not have been possible thus to limit improvements, which, in whatever district they had begun, must have been adopted throughout the country as speedily as the requisite knowledge could be diffused or the needful apparatus obtained.

The 12 distinct districts in which the making of iron is prosecuted in France are thus distinguished in the official reports:—

	DEPARTMENTS.
1. Group of the North-east,	Ardennes, Moselle, Meuse.
2. " of the North-west,	Eure, Orne, Mayenne, Morbihan. Sarthe, Loire Inférieure, Côte du Nord, Eure et Loir, Ille et

		Vilaine, Manche, Loir et Cher, Maine et Loire.
3.	Group of the Vosges	Bas Rhin, Vosges, Moselle.
4.	" of the Jura	Côte d'Or, Haute Saône, Doubs, Jura.
5.	" of Champagne and Burgundy,	Côte d'Or, Haute Marne, Vosges, Meuse, Marne, Aube, Yonne.
	" of the Centre	Nièvre, Cher, Allier, Saône et Loir.
	" of the Indre and la Vendée	Vendée, Indre, Cher, Vienne, Indre et Loire, Loir et Cher, Haute Vienne.
8.	" of the coal-fields of the South,	Creuse, Puy-de-Dóme, Cantal, Aveyron, Gard, Ardèche, Loire, Isere, Ain.
9.	" of Périgord	Charente, Dorgogne, Lot et Garonne, Tarn et Garonne, Corrèze, Haute Vienne.
10.	" of the Alps	Dróme, Isère, Hautes Alpes, Vaucluse.
11.	" of the Landes	Landes, Gironde, Lot et Garonne.
12.	" of the Pyrenees	Basses Pyrénées, Hautes Pyrénées, Arriége, Aude, Pyrénées Orientales, Hérault, Tarn.

The actual and relative importance of these groups may be seen from the following particulars, given in the Report presented in the present year, and having reference to the working of 1836:—

Group.	No. of Iron Works	No. of Workmen.	Quantity of fuel in tons & steres.				Quantity of Products.			Value of Products in English Money.
			Wood Charcoal.	Coke.	Coal.	Wood.	Cast Iron.	Bar Iron.	Steel.	
			Tons.	Tons.	Tons.	Steres	Tons.	Tons.	Tons.	£
1	94	2,233	90,884	3,530	8,230	33,583	46,233	30,450	162	530,599
2	59	1,771	54,051	..	2,964	..	23,755	11,182	..	210,238
3	7	388	..	7,315	24,830	..	2,226	9,189	..	147,500
4	148	2,090	126,754	..	910	..	54,737	28,900	581	652,030
5	152	2,807	139,602	..	40,947	..	81,499	42,309	..	691,528
6	124	2,133	71,098	14,094	35,798	..	36,993	27,029	766	501,362
7	21	499	17,564	..	..	..	5,824	2,870	..	61,085
8	15	1,243	..	87,444	115,038	..	28,440	27,276	..	377,158
9	115	1,175	39,120	..	3,399	..	14,893	9,064	96	173,646
10	39	174	6,614	..	251	..	2,021	282	1,120	6,916
11	21	410	17,466	..	32	478	7,118	3,674	..	62,535
12	99	815	30,742	..	..	..	..	9,466	..	171,140
	894	15,738	593,855	112,383	232,399	34,061	303,739	201,691	2,725	3,585,739

The figures given in the foregoing table do not present in all their importance the extent of this branch of industry in France. The number of workmen employed for the production of pig-iron *(fonte)*, malleable iron *(gros fer)*, and steel, which alone are there included, does not much exceed one-third of the number engaged in all the various processes of the iron manufacture; and the total value of the material produced, instead of being, as in the above statement, £3,585,739, amounted in 1836, according to the

returns of the inspectors, to £4,975,424. The following abstract contains all that it appears desirable to offer on this occasion, and presents under five principal divisions the total number of workmen engaged in the manufacture, with the value created by them in each of those divisions:—

	Number of Workmen.	Value Created.
1. Extraction and Preparation of the Ore . .	17,557	£500,632
2. Production of Pig-Iron *(fonte)*	6,776	1,969,132
3. Production of Malleable Iron *(gros fer)* .	8,678	1,506,247
4. Founding, Drawing, Rolling, &c. . . .	8,615	812,486
5. Converting, Moulding, Casting, &c. Steel .	2,149	186,927
Total,	43,775	£4,975,424

Rather more than 40 per cent. of the value here stated is made up of the cost of the fuel used in the various processes, viz:—

Wood Charcoal	£1,643,826
Wood	13,040
Coke	96,972
Coal	285,235
Peat	694
	£2,039,767

This sum is divided among the different processes in the following proportions:—

	£	Decimal Proportion.
1. Roasting the Ore	1,782	0.087
2. Smelting	1,132,039	55.500
3. Refining, Puddling Furnaces, &c.,	737,888	36.175
4. Casting, Drawing, Rolling, &c.	121,556	5.959
5. Moulding, Casting, &c. Steel .	46,502	2.279
Total, . .	2,039,767	100.000

It will be seen that four-fifths in value of the fuel is composed of wood. Coke was not used in the iron-works of France until 1821, and at the present time is employed almost exclusively for processes subsequent to smelting the ore. The proportionate value of different kinds of fuel consumed in the various processes, in each year from 1833 to 1836, has been,—

	1833	1834	1835	1836
Wood Charcoal	0.838	0.818	0.864	0.806
Coal	0.098	0.129	0.098	0.140
Coke	0.062	0.050	0.037	0.048
Wood	0.002	0.003	0.001	0.006
	1.000	1.000	1.000	1.000

The average prices of the different kinds of fuel in 1836, as stated in the Report, were—

Wood Charcoal . .	54*s.*	10*d.*	per ton.
Coal	18	5	"
Coke	20	3	"
Wood	2	10	per stere.

The increased proportion of wood, observable in the working of 1836, is caused by the substitution in part, in some works, of wood dried by heat or partially carbonized.

By the introduction of a proportion of dry wood in place of charcoal, a diminution in the cost of fuel has been attained; but against this advantage must be placed the smaller produce obtained from the furnace in a given time, as well as a diminution of metal from a given quantity of ore.

Where wood charcoal alone is used for smelting, it requires eighteen metrical quintals for the production of thirteen metrical quintals of iron. Where coke and coal are used in the proportion of ten of the former to nine of the latter, it requires about three quintals of fuel to produce one quintal of iron. In some cases, coke is used with charcoal in the proportion of one quintal of coke to two quintals of charcoal, and the produce has been eight quintals of iron for ten quintals of fuel. In the first case, (where wood charcoal is used,) the cost of the fuel has been 9.92 fr. per metrical quintal of iron, or 4*l.* 0*s.* 6*d.* per English ton. The cost when coke and coal are used, is stated to be 4.45 fr. per quintal, or 36*s.* 1½*d.* per ton; and in the third case, where coke and charcoal are mixed, the cost is said to be 7.60 fr. per quintal, or 3*l.* 1*s.* 8*d.* per ton. The value assigned to the produce is,—

In the first case,	20.99 fr. per quintal, equal to	£8 10 4	per ton.
In the second case,	11.13 fr. " "	4 10 4	"
In the third case,	20.32 fr. " "	8 4 11	"

The mixture of coke and charcoal would, upon the whole, appear to be the most profitable in its result. Deducting from the value of the metal the sum expended for fuel, there would remain, when charcoal alone is used, 4*l.* 9*s.* 10*d.* per ton; when coal and coke are used 2*l.* 14*s.* 2½*d.* per ton, and when coke and charcoal are used 5*l.* 3*s.* 3*d.* per ton. These calculations are of course wholly inapplicable to the circumstances in which the manufacture is placed in this country from the actual and relative cheapness of our mineral fuel.

The use of the hot blast has been adopted in several of the furnaces in France. At first it was found that the iron thus obtained was not so well adapted for making bar iron as that for the smelting of which cold air had been used; but some modifications, which are not particularized in the Reports, have been introduced into the process, and this disadvantage has been remedied.

No account is given of the quantity of iron made in France earlier than 1824; but from that year the account is regularly stated in the Reports, from which the following abstract has been computed:—

Years.	Pig-Iron.	Malleable Iron	Years.	Pig-Iron.	Malleable Iron
	English Tons.	English Tons.		English Tons.	English Tons.
1824	194,636	139,564	1831	221,423	138,942
1825	195,588	141,396	1832	221,660	141,336
1826	202,756	143,336	1833	232,559	149,982
1827	213,175	146,621	1834	265,028	174,507
1828	217,604	149,117	1835	290,378	206,396
1829	213,868	151,319	1836	303,739	201,691
1830	222,965	146,242			

As in the case of coals, the importations of foreign iron into France have kept pace with the increase in the native production. The Custom House accounts of that country are detailed with great minuteness; but it is not

necessary here to particularize the quantities of each description of foreign iron used in France. The value so consumed in each year since 1815, and the amount of duty collected on the same, were as follows:—

Years.	Value of Foreign Iron Imported for use.	Amount of Duty collected.	Years.	Value of Foreign Iron Imported for use.	Amount of Duty collected.
	£.	£.		£.	£.
1815	87,556	29,840	1826	218,212	130,326
1816	98,063	45,600	1827	186 846	98,960
1817	202,205	122,024	1828	179,635	95,073
1818	163,173	89,491	1829	160,625	84,396
1819	164,238	94,180	1830	187,117	100,476
1820	162,107	81,517	1831	123,185	63,644
1821	226,571	126,945	1832	159,222	82,192
1822	144,193	74,540	1833	174,601	91,569
1823	141,501	86,258	1834	200,573	104,598
1824	164,812	94,157	1835	231,208	121,346
1825	150,690	86,894	1836	252,702	122,842

The production in France of metals, other than iron, is of little or no commercial importance at the present time. The whole value created in the articles of lead and silver, antimony, copper, and manganese, amounted in 1836 to less than 60,000*l.*, and gave employment to only 1760 workmen. In noticing this fact the inspectors encourage the hope that some considerable addition may shortly be made to the produce of mining industry applied to the articles just enumerated; they do not, however, explain the grounds upon which this hope should be entertained, further than by noticing the existence in the country of several promising fields for that industry hitherto allowed to remain unproductive, and by stating that they are occupied in collecting information which may serve to facilitate the future attempts of persons desirous of embarking their energies and their capital in this direction.

Lead and Silver.—There are 11 lead-mines in operation in France, situated as under—

Hautes Alpes	2,	produced, in 1836,	46	Tons,	valued at	£1,175
Finistère	1	"	504	"	"	11,692
Gard	1	"	4	"	"	80
Isére	1	"	54	"	"	848
Loire	1	"	22	"	"	260
Lozére	1	"	47	"	"	1,316
Puy-de-Dôme	1	"	30	"	"	740
Rhône	3	"	6	"	"	98
	11		713			£16,209

The Silver obtained from the soil of France is separated from the produce of some of the lead-mines above mentioned: the quantity and value thus yielded in 1836 were,—

Hautes Alpes . . .	203	lbs.,	valued at	£660
Finistére	3,517	"	"	11,542
Lozére	1,028	"	"	3,388
Puy-de-Dôme . . .	324	"	"	1,060
	5,072			£16,650*

* The value put upon this produce in the Report is thus 5*s.* 6*d.* per oz.

The quantity of lead of native production supplies but a small part of the wants of the country. The importations into France from foreign countries, principally Spain, for consumption during the five years from 1832 to 1836, have averaged 14,800 tons per annum.

Antimony.—This mineral is produced in France from 11 mines, viz:—

Allier . .	1, which produced, in 1836,	138	Tons,	valued at	£3,864
Ardéche .	1 "	63	"	"	1,944
Gard . .	1 "	23	"	"	628
Haute-Loire	2 "	22	"	"	652
Lozére . .	4 "	35	"	"	960
Puy-de-Dôme	2 "	130	"	"	4,073
	11	411			£12,121

Copper.—The produce of copper-mines in France, five in number, is quite inconsiderable; three of these mines are in the department of Hautes Alpes, and two are in the department of the Rhone. The quantity of metallic copper which they yielded in 1836 was only 102 tons, and its value £7,877. The yearly consumption of foreign copper, principally the produce of Russia and of England, during the five years from 1832 to 1836, has averaged 6235 tons.

Manganese.—The manganese-mines are situated as follows:—

Allier . .	1, which produced, in 1836,	365	Tons,	valued at	£1,628
Aude . .	1 "	148	"	"	570
Dorogne . .	3 "	215	"	"	951
Haute-Saône	1 "	39	"	"	31
Saône-et-Loire	1 "	900	"	"	2,926
	7 Mines.	1,667	Tons.		£6,106

The engineers to whom the task of inspecting the mining establishments of France is entrusted have not confined their enquiries to the objects which have been noticed in this paper: they have included in their Annual Reports the statistics of various branches of industry in which mineral substances are produced or employed; such as bituminous minerals—alum—sulphate of iron—and salt; the produce of quarries—of glass-houses—of porcelain and pottery manufacturies—of copper and zinc works—and of chemical processes. By this means, it is shewn that the number of workmen who in 1836 depended for subsistence upon mining operations and their consequences, amounted to 273,364, while the total value created by their joint labour amounted to 377,684,791 fr., or £15,107,392, viz:—

	Establishments.	Workmen.	Value created.
			Francs.
Coal, Lignite, Anthracite, and Peat, .	2,219	55,735	30,533,922
Iron and Steel, ...	..	43,775	124,385,616
Lead, Silver, Copper, Antimony, Manganese,	..	1,760	1,476,161
Bitumens, ...	6	245	192,128
Alum and Sulphate of Iron, ...	19	1,141	1,760,667
Salt, ...	..	16,615	10,397,164
Quarries, ...	..	70,396	40,350 419
Glass Manufactures, ...	..	10,497	47,474,301
Porcelain, Pottery, and Earthenware, .	..	20,480	27,418,122
Bricks and Tiles, and Lime, ...	..	44,604	51,939,239
Plaster, ...	..	4,298	14,713,796
Chemical Products, ...	..	2,216	22,043,732
Copper, Zinc, and Lead Works, . .	..	1,597	4,999,524
		273,364	377,684,791

Jour. Statis. Soc.

Note on the Art of Photography, or the Application of the Chemical Rays of Light to the Purposes of Pictorial Representation. *By* Sir John F. W. Herschel, Bart., K. H., V. P. R. S., &c.

The author states that his attention was first called to the subject of M. Daguerre's concealed photographic processes, by a note from Captain Beaufort, dated the 22nd of January last, at which time he was ignorant that it had been considered by Mr. Talbot, or by any one in this country. As an enigma to be solved, a variety of processes at once presented themselves, of which the most promising are the following: 1st, the so-called de-oxidizing power of the chemical rays in their action on recently precipitated chloride of silver; 2ndly, the instant and copious precipitation of a mixture of a solution of muriate of platina and lime-water by solar light, forming an insoluble compound, which might afterwards be blackened by a variety of agents; 3rdly, the reduction of gold in contact with deoxidizing agents; and, 4thly, the decomposition of an argentine compound soluble in water, exposed to light in an atmosphere of peroxide of chlorine, either pure or diluted.

Confining his attention, in the present notice, to the employment of chloride of silver, the author inquires into the methods by which the blackened traces can be preserved, which may be effected, he observes, by the application of any liquid capable of dissolving and washing off the unchanged chloride, but of leaving the reduced, or oxide of silver, untouched. These conditions are best fulfilled by the liquid hyposulphites. Pure water will fix the photograph, by washing out the nitrate of silver, but the tint of the picture resulting is brick-red; but the black colour may be restored by washing it over with a weak solution of hyposulphite of ammonia.

The author found that paper impregnated with the chloride of silver was only slightly susceptible to the influence of light; but an accidental observation led him to the discovery of other salts of silver, in which the acid being more volatile, adheres to the base by a weak affinity, and which impart much greater sensibility to the paper on which they are applied; such as the carbonate, the nitrate, and the acetate. The nitrate requires to be perfectly neutral; for the least excess of acid lowers in a remarkable degree, its susceptibility.

In the application of photographic processes to the copying of engravings

or drawings, many precautions, and minute attention to a number of apparently trivial, but really important, circumstances, are required to ensure success. In the first transfers, both light and shadow, as well as right and left, are the reverse of the original: and to operate a second transfer, or by a double inversion to reproduce the original effect, is a matter of infinitely greater difficulty; and in which the author has only recently ascertained the cause of former failures, and the remedy to be applied.

It was during the prosecution of these experiments that the author was led to notice some remarkable facts relating to the action of the chemical rays. He ascertained that, contrary to the prevailing opinion, the chemical action of light is by no means proportional to the quantity of violet rays transmitted, or even to the general tendency of the tint to the violet end of the spectrum: and his experiments lead to the conclusion that, in the same manner as media have been ascertained to have relations *sui generis* to the calorific rays, not regulated by their relations to the rays of illumination and of colour, they have also specific relations to the chemical spectrum, different from those they bear to the other kinds of spectra. For the successful prosecution of this curious investigation, the first step must consist in the minute examination of the chemical actions of all the parts of a pure spectrum, not formed by material prisms, and he points out, for that purpose, one formed in Fraunhofer's method, by the interference of the rays of light themselves in passing through gratings, and fixed by the heliostat.

He notices a curious phenomenon respecting the action of light on nitrated paper; namely, its great increase of intensity, under a certain kind of glass strongly pressed in contact with it; an effect which cannot be explained either by the reflection of light, or the presence of moisture; but which may possibly be dependent on the evolution of heat.

Twenty-three specimens of photographs, made by Sir John Herschel, accompany this paper: one, a sketch of his telescope at Slough, fixed from its image in a lens; and the rest copies of engravings and drawings, some reverse, or first transfers; and others second transfers or re-reversed pictures.

Lond. and Ed. Philos. Mag.

Latanium—A New Metal.

M. Berzelius, in a letter to M. Pelouze, dated the 22nd of February, states that M. Mosander, in submitting the cerite of Bastnaes, in which cerium was met with twenty-five years ago, has discovered a new metal.

The oxide of cerium, separated from the mineral by the usual process, contains nearly two-fifths of its weight of the oxide of the new metal, merely altered by the presence of the cerium, and which, so to speak, is hidden by it. This consideration induced M. Mosander to give the new metal the name of *latane* or *latan*.

It is prepared by calcining the nitrate of cerium, mixed with nitrate of latanium. The oxide of cerium loses its solubility in weak acids; and the oxide of latanium, which is a very strong base, may be separated by nitric acid, mixed with 100 parts of water.

Oxide of latanium is not reduced by potassium; but by the action of potassium on the chloride of latanium a grey metallic powder is obtained, which oxidizes in water with the evolution of hydrogen gas, and is converted into a white hydrate.

The sulphuret of latanium may be produced by heating the oxide strongly in the vapour of oxide (sulphuret?) of carbon. It is of a pale yellow colour,

decomposes water with the evolution of hydro-sulphuric acid, and is converted into a hydrate.

The oxide of latanium is of brick-red colour, which does not appear to be owing to the presence of oxide of cerium. It is converted by hot water into a white hydrate, which restores the blue colour of litmus paper reddened by an acid; it is rapidly dissolved even by very dilute acids; and when it is used in excess, it is converted into a subsalt. The salts have an astringent taste, without any mixture of sweetness; the crystals are usually of a rose-red colour. The sulphate of potash does not precipitate them, unless they are mixed with salts of cerium. When digested in a solution of hydrochlorate of ammonia, the oxide of latanium dissolves, with the evolution of ammonia. The atomic weight of latanium is smaller than that assigned to cerium; that is to say, to a mixture of the two metals.

M. Berzelius has repeated and verified the experiments of M. Mosander. —*L'Institut*, 14 *Mars*, 1839. Ibid.

NOTICES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

New Application of Dextrine. *By* BARON DE SYLVESTRE.

I have the honour to announce to the Society that I have just made a new application of Crude Dextrine in employing it as a temporary varnish for oil paintings. At the last exposition of the Saloon a great number of pictures were so confused by the imbibition of the colours, that it was impossible to appreciate them properly, and I was induced to seek for some remedy for this serious inconvenience which common varnish will not obviate, since it cannot be applied until long after the painting is finished. The nature of dextrine and the various qualities which have given it already so much extension in the arts, induced me to think that it might produce happy effects in this case, and, in fact, numerous trials have convinced me that crude dextrine, dissolved in diluted alcohol, will completely prevent the effect of imbibition, even when employed a few days after the finishing of the picture. Applied with a soft brush it gives to the whole picture a sort of clearness like a light varnish, which can be easily removed by a moist sponge, when, after a few months, common varnish may be applied with its ordinary brilliant effect, without inconvenience.

Sometimes the fat oils which have been used too freely in painting, obstruct the uniform adhesion of the solution of dextrine on the picture, and occasion the formation of small liquid drops, which, in drying, produce spots. In this case a sponge moistened with warm water must be passed over the picture to remove the first coat, and then it should be rubbed lightly with soap water previous to renewing the dextrine, which, after this, spreads uniformly over the whole picture.

The solution of dextrine, as above prepared, serves as a perfect varnish for water colours and for fixing pencil and crayon drawings, so as to prevent any injury from rubbing.

The solution of dextrine, in about an equal portion of warm water, furnishes a paste which remains liquid and possesses great energy. It may be used for drawings, engravings, and all sorts of pasteboards and paper, and as a substitute for the greater number of common pastes with decided advantage.

Rec. Soc. Poly. Juel. 1838.

Obliteration of Indelible Ink.

Marks made with this Ink may be effaced by wetting the stuff on which they are written thoroughly with liquid Ammonia. In ten minutes the colour becomes pale, and in a short time completely disappears.

The reputation of marking inks depends on the difficulty of removing from the stuff the oxide of silver, which is formed from the nitrate, the base of these inks. Ammonia dissolves this oxide without leaving a trace of its existence. Idem.

New Phosphoric Matches.

On the subject of these matches, the committee of health and safety in Paris, remark as follows, relative to their fabrication:

"Every body is acquainted with the new and elegant matches, which, on account of their convenience and cheapness, are now preferred to all others. They may be said to have totally supplanted the red matches. They inspire, it is true, some fear of danger, but when examined closely, we find this fear to be unfounded. The first matches were naturally very imperfect. They took fire on the slightest friction and sometimes on a simple exposure to the sun. It was therefore with reason that Councellor Trousrof awakened public attention to the danger of using them; and yet the fabrication of these matches has not been the less prosperous.

"The friction matches now sold may be strongly shaken in the box containing them without inflaming. They ought not certainly to be given to children as play things; but if governments were to be influenced by these considerations they must interdict the use of flint and steel, and must watch with especial care the manufactories, to prevent the sale of sulphur, sulphuric acid, burning glasses, ceruse, &c. &c, which would involve them in the ridiculous.

"Our aim in publishing this article is to enable our readers to partake in the advantages of so useful an invention, by communicating the following process. We should observe that although these matches may not be dangerous, they ought not, nevertheless, to be kept in heaps, nor should governments allow them, under any pretext, to be fabricated in the large way in a town or near dwelling houses, for the least negligence might cause a fire which could not be extinguished, and even in making them in a small way, the greatest care ought to be used.

Preparation.—Put a quantity of mucilage of gum arabic into an earthenware vessel and heat it to the temperature of 40° or 50° C. (= 100 to 125 Far.) and to four parts of the mucilage add one part of phosphorus: it instantly melts; stir it so as to mix it well with the mucilage, and when well divided, add chlorate of potash in powder, nitrate of potash and a little Benzoin, so as to form a soft paste: into this dip the ends of the match sticks. The mass constitutes what is called *fulminating tinder.* Idem.

Observations.—The Editors of the French Journal designate a number of grave accidents which have occurred in Paris in consequence of these matches, such as fires, loss of eyes, &c., and urge the expediency of an injunction, on the part of the administration, that they be manufactured in localities detached from other buildings, and if possible in fire-proof rooms, —that they be packed and sold only in separate boxes, and to recommend

that no more paste be used than is sufficient for inflammation, and when transported to a distance that they be inclosed in solid cases, and the contents carefully marked as in the regulation for percussion caps.

Some prohibitory police regulations on this subject would doubtless be advisable in our cities and villages. The committee appointed by the corporation of New York to investigate the causes of fires, ascribe a number of their annual conflagrations to the imprudent use of these matches.

Of the various kinds of matches which have come under our notice, there is none which, as a medium between convenience and safety, we prefer to the Lucifers, especially as prepared by Jones, of the Strand, London, and imported by our wholesale Druggists. They require the aid of the sand paper, and scarcely one in a box will fail to ignite with its use.

We were offered lately in the streets of Pittsburgh a kind of loco-foco matches which were new to us, and were told that they are made by the cart load on the Monongahela River. A block of dry wood about one inch and a half long on each side, is sawn (but not entirely through,) in two directions, so as to leave more than a hundred detached upright pieces each the size of a match. The ends of these are dipt together in the paste, and when a match is wanted it is broken from the block. Being thus detached they can be transported with much less danger than when in compact bunches. They ignite by friction on almost any surface and burn as if containing phosphorus. The composition *may be* the same as that given in the above recipe. G.

Organic Chemistry. Pyrogenous products of Amber.

M. M. Pelletier and Walter state that in examining the action of heat in amber, one substance among others which they have obtained and analyzed, appears well worthy of notice.

This is a white, crystalline substance, soluble with difficulty in alcohol and ether, and acquiring an intense blue colour from the action of sulphuric acid. Their analysis leads to the formula $C^3 H^1$.

This substance has therefore the same composition as Idrialene. It exhibits also all its properties. Idrialene, discovered by M. Dumas, has hitherto been met with only in a mineral, the locality of which is lost, and which is met with only in a small number of mineralogical collections.

The authors, however, do not decide upon the identity of Idrialene and the substance they have found in amber. In case they should prove to be only isomeric, they propose to give it the name of *Succisterene*.

L'Institut, No. 235.

New Compound of the Oxide and Chloride of Antimony.

M. Langlois announces that he has just found a new compound of the oxide and chloride of antimony, which presents all the characters of a true salt, and is different from the powder of Algaroth. This oxichloride is composed of

Chloride of antimony, ...	13.65
Oxide of antimony, ...	86.35
	100.00

Idem, No. 238.

Iodide of Chromium.

The beautiful compounds of Chromium with Chlorine and Fluor have been long known, but the Iodide of Chromium has but just been obtained by M. Herbert Giraud. His method is altogether similar to that generally pursued for nitri-chloride and tri-fluoxide of chromium. Like all other compounds of the same metal, it is remarkable for its splendid colour, which is a deep granite red. It is a fluid of an oily consistence, heavier than water. Heated to 130° C. it goes off in vapour of the same colour as the liquid itself. Exposed to the air it produces aqueous fumes; mixed with water it changes into chromic and hydriodic acids. It destroys organic substances, blackens paper and wood, stains the skin with a deep, permanent brownish red, destroys the cuticle, and is poisonous to vegetables and animals. Idem, No. 241.

Filtration of Hydrogen Gas through Caoutchouc.

M. Cagniard-Latour, in experimenting on the permeability of membranous envelopes, ascertained that a small balloon of caoutchouc, well prepared, appears to be completely tight to atmospheric air; i. e. once inflated, it remained so indefinitely; but that the same bottle filled with another gas—for example, oxygen, azote, carbonic acid or hydrogen, became very sensibly loose or uninflated. With hydrogen the collapse was more prompt than with the others.

In seeking for the cause of this rapid escape of hydrogen, he filled a balloon with it, and kept it for some time under water. In a few hours, the surface was nearly covered with small gaseous bubbles, and the size of the balloon appeared sensibly diminished. On examining the gas after its escape, it appeared to be the same as before, nor had the caoutchouc membrane undergone any alteration. The result appeared to be simply the effect of mechanical filtration.

The thickness of the balloon membrane in these experiments was only the fourth of a millimetre ($= \frac{1}{1000}$ of an inch), but the author had tried others much thicker, and found that when suitably compressed, hydrogen would escape through them. Idem, No. 245.

Electricity of Friction.

Dr. Wollaston, in a memoir published in 1800, says: "To ascertain positively whether oxidation contributes to the development of electricity, I mounted a little cylinder, with cushions, and conductor, in a glass, so arranged that I could change the air it contained at pleasure. After trying its energy in common air, I substituted carbonic acid, and found that all development of electricity was suspended. It returned immediately when atmospheric air was again introduced.

In a note by Gay Lussac, on this passage, it is said: "electricity is obtained with very oxidable amalgams, in an atmosphere of carbonic acid, provided this gas is deprived of the greater part of its hygrometric water."

M. Peclet has determined, as he alleges, that Dr. Wollaston was decidedly in error. He constructed an apparatus with a cylinder, cushion and conductor, so disposed that he could introduce and discharge the gases in a dry state. With this he operated with air, hydrogen and carbonic acid,

and for the two last, the experiments were not made until the containing vessel had been filled and emptied six times successively. The results were precisely the same in all the experiments. Hence he infers that in the production of electricity by friction the action of the air on the coating or amalgam, whether more or less oxidable, is without any influence.

Idem, No. 246.

In a subsequent memoir by the same author, we are told "that the production of electricity of a high tension, by the friction of slipping, by rolling, or by pressure, proceeds neither from chemical action, from shaking, (ebranlement) nor from an approximation of the molecules of a body; it results solely from contact; the increase of pressure or of motion during contact has no other effect than to increase the number of touching points, and that swiftness as well as the direction of the motion which produces separation, is without any influence."

Idem, No. 247.

Zinc. Sounds Produced by Heating it.

M. Strehlke has observed some peculiarities relative to this curious phenomenon. If a spirit lamp be placed under a disc of zinc, supported from several points, or under a bar of the same metal resting on two prismatic supports, in the course of a few minutes sounds are heard somewhat like those of a chime of sleigh bells at a distance, succeeding each other rapidly. The same sounds may be produced also by cooling the metal, when heated, by covering it with a piece of ice, or better, by a freezing mixture. If the bar of zinc be laid on a table, with one end projecting over the edge, the sounds are produced by placing the alcoholic lamp under the projecting end of the bar. In this case, the noise is a sort of confused crackling.

The experiments of M. Strehlke were made on a disc of several lines in thickness, and a bar of cast zinc two feet long, sixteen lines wide and $4\frac{1}{2}$ lines thick. He tried in vain to produce the same phenomenon with other metals than zinc.

Idem.

Xyloïdine.

This name was given by Braconnot some years ago, to a substance formed by the action of concentrated nitric acid on starch, lignin, and some other substances, but the particular circumstances attending its formation were not examined, nor its properties well investigated. M. Pelouse has made it the object of his study. When nitric acid, density 1.5, is added to starch, the latter, in a few minutes, disappears completely, the solution retains the yellow colour of concentrated nitric acid, and no elastic fluid is disengaged. If treated immediately by water, the xyloïdine is entirely precipitated, and the filtered fluid leaves by evaporation scarcely any residuum.

If instead of precipitating immediately by water, the solution be left to repose in a closed bottle, its colour passes through the various tints of a mixture of nitric acid and nitric oxide. The water in it then precipitates the xyloïdine in a gradually diminishing quantity, and in the course of two days, and sometimes in as many hours, it becomes quite clear, and regains its transparency, the xyloïdine being destroyed and transformed completely into a new acid, which is obtained by evaporation in a white mass, solid, uncrystalizable, and deliquescent, and weighing more than the starch origi-

nally dissolved. Neither carbonic nor oxalic acid is produced during the reaction.

Xyloïdine is a compound of nitric acid and starch, an atom of water in common starch being replaced by an atom of nitric acid. The whole starch is transformed into this substance, a fact which explains perfectly the increase of weight, when the xyloïdine is precipitated by water immediately after the solution of the starch in nitric acid. As an excess of this acid transforms the xyloïdine into a very soluble substance, which is no other, says M. Pelouse, than the acid I have mentioned, we have an explanation of a different result obtained by Braconnot. This chemist procured from a given weight of starch, an equal weight of xyloïdine. This evidently arose from the decomposition of a portion of the latter substance. By retarding the precipitation still longer, he would have found the impossibility of obtaining the slightest trace of xyloïdine.

When instead of leaving the solution at rest, the temperature be raised to ebullition, the starch is decomposed in a few minutes, and transformed into a deliquescent acid, which is easily obtained pure and in great quantity by evaporation in the water bath.

This acid contains no azote; it has some relation to oxalhydric acid (nitrosaccharic) but differs from it in composition. A moderate heat converts it into another acid of a dark colour, soluble in water, and from which, by the action of nitric acid, the white acid from which it was derived, may be regenerated.

Concentrated nitric acid, at a boiling heat, attacks it with the greatest difficulty. When cold, it changes it slowly into oxalic acid, without the production of carbonic acid. Hence by slow oxidation, excited by the presence of a suitable quantity of concentrated nitric acid, starch is successively converted into xyloïdine, into a deliquescent acid and into oxalic acid, without any participation of the carbon in the displacement of the other elements of these matters. These curious changes take place spontaneously in the cold in close vessels.

Xyloïdine is hence to be regarded as a kind of salt, in which the starch acts the part of a base to the acid. It is accordingly very combustible, taking fire at 180° C., and burning away rapidly without leaving any residuum. This led the author to an experiment which may be applicable to artillery. Dipping paper into nitric acid of 1.5 density, allowing it to become thoroughly penetrated, which is done in two or three minutes, and then washing it thoroughly in clean water, a kind of parchment is obtained, which is impermeable to moisture, and extremely combustible. Tissues of linen and cotton are acted upon in the same way. Idem, No. 25'.

Secretions.

According to the observations of M. L. Mandl, all the secretory organs supplied with nerves from the cerebro-spinal system give out alkaline secretions; and all the organs whose nerves are from the ganglionic system, produce an acid secretion. He remarks that the presence of a few greyish fibres proceeding from the ganglionic system, as proved by several anatomists, in the midst of cerebro-spinal nerves, may explain the small quantity of acid found in alkaline secretions, and which concur in the formation of salts in these secretions. In the same manner, he adds, the acknowledged presence of some fillets of nerves from the cerebro-spinal system, in the ganglion nerves is accompanied with a little alkali, as soda, &c., in the

acid secretions. The dominant quantity of nerves, therefore, from one or the other system determines the chemical character of the secretion. One single secretion, that of the skin, makes an exception to this observation, for the sweat is acid. But my experiments induce me to hope to be able soon to resolve this difficulty; it is probable that the sweat owes its acid character to the influence of the air. Idem.

Heat of Electricity.

Mr. Humbold presented in the name of M. Riess a memoir printed in German, containing some new experimental and analytical researches on the quantity of heat which electricity produces in metallic wires. The results are as follows:

If an electric battery is discharged through a silver wire 118.7 inches in length, through a gold wire 88.8 inches, and through a platina wire 15.5 inches; they will, when of equal thickness, experience an increase of temperature very different; but if we suppose them surrounded with ice after the discharge, they will each melt equal quantities of it in returning to their primordial temperature.

The calorific force of a metal, that is to say, the quantity of heat developed in each metal by an electric discharge, may be found by dividing the retarding electric force by its capacity (specific heat) and its specific weight.

When different metallic wires are united for the discharge of a battery, the quantity of heat developed is proportionate to the retardation which each wire produces during an electric discharge.

M. Arago observed that these results coincide in many points with those obtained by M. Peltier, in his researches on the same subject.

Idem, No. 252.

Electricity in a Vacuum.

A note being presented at the session (October 8th) from M. Masson, for the purpose of showing that, in certain conditions, the electric current did not pass through a vacuum between the poles of a strong pile, M. Arago observed that M. Savary had long ago succeeded in producing magnetization by the discharge of electricity of tension, developed by friction, and instantaneously discharged through a vacuum. For example, a glass tube, void of air, and a brass rod sensibly equal in diameter to the tube, being placed in the same circuit, the discharge magnetized needles in an equal degree, placed at the same distance from the tube and the rod. It results from this experiment, that electric motion may develope magnetism without the intervention of ponderable matters directly in its course.

Idem.

Progress of Physical Science.

Upon the alleged Influence which the Roughness and the Polish of Surfaces exercises upon the Power of Bodies to emit Heat, in reference to the Experiments of Professor Sir John Leslie. By M. Melloni.

When we measure the intensity of calorific radiation which takes place from the two sides of a metal vessel filled with boiling water, having the

one of its longitudinal sides highly polished and brilliant, and the other, though at first polished, yet subsequently more or less streaked or furrowed with emery, or with the graver, or the file, we discover that the quantity of heat emitted by the streaked or unpolished surface, is always superior to that which emanates from the brilliant one. These variations sometimes exceed the ratio of two to one. Hence a deduction has been drawn, that the observed increase is owing to those inequalities which have been impressed upon the vessel, and that, consequently, the superficial asperities of bodies have the property of facilitating the exit of the heat which they contain. I beg the honour of communicating to the Academy the abstract of a series of researches, whence it seems decidedly to follow that this proposition is wholly erroneous; so that if the superficial layers clearly and decidedly contribute to make a difference in the quantity of heat emitted by a hot body, the state of the surface has no part in the production of this phenomenon.

First, I must avow that, in spite of the authority of great names, the influence of this polish in calorific emission, has always appeared to me very doubtful. It is said, the interior heat experiences in quitting the body the same action of the surface which it undergoes in penetrating it in the way of radiation. Be it so. But why should these small shining *facets* (*facettes miroitantes*) which you produce by streaking the polished plate, reflect interiorly less heat than the surface *uniformly polished?* Take a vessel of copper, having two polished sides slightly obscured by exposure to the air: make with the graver on one of these sides, a series of parallel furrows; the little furrows thus produced, will certainly be more brilliant than the rest of the vessel, and, notwithstanding, the furrowed surface will emit more heat than the smooth one.

It is now nearly two years since I imparted this objection and some other experiments of the same sort, to Messrs. Bache, Henry, and Locke, distinguished professors of physics from the United States, who were then in Paris. Now, however, that the question appears to me decided, I lay aside all indirect objections, and pass immediately to the exposition of results which conduce directly to the proof of the alleged fact.

I took a cubic vessel of copper, whose four faces were very carefully formed; externally, I soldered on its lower angles and edges, grooves provided with springs, for the purpose of supporting firmly against the vessel plates of two or three lines in thickness; and having afterwards procured two pairs of plates, one pair of jet, and the other of ivory, I applied them to the four sides. Each pair was composed of plates in every respect alike, except as it regarded the external surface, one of which was very smooth and brilliant, and the other was not polished, and was streaked with emery. On precisely measuring with the thermo-multiplier, the quantities of heat projected by the two polished faces, when the vessel was filled with hot water, and in comparing them with those which emanated from the corresponding streaked faces, I could only perceive differences to the extent of one or two hundredths (*centièmes,*) and these sometimes on the one side and sometimes on the other. The mean of twenty observations yielded only a variation which scarcely amounted to a few thousandths (*millièmes,*) and, consequently, might be altogether disregarded.

To this experiment it may perhaps be objected, that in spite of the precautions taken for the establishment of a perfect contact betwixt the plates and the vessel, we have nevertheless no certainty that the two plates which composed each of the pairs submitted to experiment, possessed the same

temperature. To avoid this objection, I caused a square reservoir to be hollowed out of a small block of marble, the sides of which were reduced to a perfectly equal thickness, and the external surfaces of which were differently prepared. The first was smooth and brilliant; the second was equally smooth, but unpolished and tarnished; the third was streaked in one direction; and the fourth in two, crossed at right angles. The vessel was then filled with hot water, and *projected the same quantity of radiating caloric from each of the four sides.*

Hence, it appeared that the more or less irregular state of the surface has no influence upon the emissive power, when the radiating body is not of a metallic nature.

I then covered with lamp-black one of the faces of my marble vase, as well as one of each of the pairs of plates I had employed in the preceding experiment. As it has been agreed to represent by the number 100, the emissive power of lamp-black, I could easily determine, by successive comparisons, the proportional numbers which represented the emissive powers of ivory, jet, and marble. The whole three were found to be comprised between the numbers 93 and 98. But here might it not be said, that if in the substances which were thus employed, the influence of the unpolishing is nothing, this is owing to their emissive power reaching the limit of maximum, beyond which an augmentation can scarcely occur, because the emissive surface no longer supplies a hindrance to the escape of the heat; whilst in metals, far removed from this limit, the alteration of the state of the surface must necessarily exercise all its influence, and render it sensible by a marked variation in the quantity of caloric emitted?

Although this reasoning is based upon a pure hypothesis, viz. that lamp-black opposes no resistance to the radiation from the surface; and although the emissive powers of the three substances employed are indeed, on the one hand, so far removed from the number 100, as to permit us to appreciate the variations produced, and yet, on the other, are so energetic that the smallest proportion of change occurring in their values, would make them overcome the whole distance which separates them from this number; notwithstanding, let us for a moment abandon all these non metallic substances, and endeavour to determine the question from the bodies themselves with which we are now more especially concerned.

Copper, zinc, tin, and tin-plate, so far as I know, are the only metals which have hitherto been employed in the experiment described at the commencement, on being exposed to the action of the air, are quickly covered with a slight film of invisible oxide, the presence of which is deduced, in a very satisfactory manner, from certain electrical phenomena. Now, it is known that the emissive power is much stronger from oxides than from the metals themselves. It may happen then, that the streaked surface, presenting a greater number of points of contact to the air, is more oxidated than the polished surface, and thus augments its radiating power by the simple effect of oxidation, without the more or less regular arrangement of the superficial parts having any thing directly to do with the result.

For ascertaining if this explanation could be maintained, all that was required was to make the experiment with gold and platina, and this I speedily did; when I found that the streaked plates of platina and gold always yielded a much more abundant calorific emission than the polished surfaces of either metal.

Oxidation then, as well as the influence of *polish in non-metallic substances*, being put out of the question, the inquiry still remains, what is the

alteration peculiar to metals which, in these bodies accompanies the change, more or less considerable, of the superficial layer?

It is no other, in my opinion, than a change of hardness or of density. Jet, ivory, and marble are, in fact, substances which are almost entirely destitute of compressibility, or at all events they do not possess, in any sensible way, the property of permanently retaining the modifications of density and hardness impressed on them by the action of mechanical force. They also readily arrange themselves in the form of plates without being subjected to pressure. On the contrary, the metals are compressible; and the common metal plates of commerce are obtained, as is known, by subjecting the metals to an extremely severe pressure by means of the hammer and rollers. Finally, experiment also proves that these plates, as well as wires, have a specific weight, and a hardness superior to those of cast metal. Who is the individual that will tell us, that this augmentation of hardness and density is uniformly distributed throughout every part of the mass? Is it not, on the contrary, probable that, during this operation, the surface undergoes a pressure and condensation greater than any other part; and that the plate is truly covered by a kind of envelope, whose density and hardness is superior to that of the internal layers?

This conceded, it is evident that by streaking the surface of a plate the less dense and hard parts will be exposed. Upon turning, then, to the tables which represent the emissive powers of bodies, it will be at once perceived that these powers follow, in general, the inverse ratio of their density. Let us admit that, according to all analogy, the same law holds regarding the different degrees of condensation of the same substance, and we may hence conclude, that, in producing these small furrows at the surface of the plate, we must obtain an augmentation of the radiating power. To this we have to add, that the parts which compose the superficial layer being loosened by the separation of their contiguous particles, must become softer, and thus acquire, by the diminution of density, an emissive power which will more nearly approach to the softer layers of the interior.

This being the case, it will result, 1*st*, that a polished plate of any given metal radiates a quantity of heat so much greater in proportion as the density or the hardness of its superficial layers is less; and, 2*d*, that, in the case of inferior density and hardness, the increase of the radiating power produced by the *un*polishing will be inferior to that obtained when the plate is denser and more thoroughly compressed.

It is almost unnecessary to add, that, for the verification of these theoretic conclusions, we must avoid employing a metal which is oxidated at a low temperature, for a plate of metal of this kind is imbued with a tendency to augment its emissive power, which varies every moment with the condition of the superficial layers, and so much the more as these layers are soft and detached.

Violent percussion, on the one hand, and a very slow transition from the state of fusion to solidity, on the other, are the two means by which we succeed in endowing metallic substances with greater or less degrees of density. Accordingly, I ordered two pairs of plates to be made of very pure silver, and gave directions that one of each pair should be hammered to a high degree, and the other should be cooled down very slowly in its sandy mould. Out of these I constructed, with the addition of a metallic bottom, a small rectangular cistern, the sides of which were united by means of soft solder, so that there might be no risk of altering their densities or tempers, during the operation. When so united, the four sides

were perfectly polished, which process had been accomplished by means of pumice-powder and charcoal, without the help of either the hammer or the burnisher. I then took coarse emery paper, and strongly rubbed, in one direction, one of each pair of the plates; the images of objects which appeared very distinct and bright upon the surfaces which were left in all their pristine polish were completely effaced upon the rubbed surfaces, which were quite obscure and covered with striæ. The vase, thus prepared, was filled with hot water; and the four sides, successively presented to the opening of my thermo-electrical apparatus, produced the following effects upon the galvanometer:—

The forged and polished plate, ...	10°
The forged and roughened plate, ...	18°
The cast and polished plate, ...	13°7
The cast and roughened plate, ...	11°3

In comparing these four radiations, we perceive, 1*st*, as to the *polished* plates, that the cast metal affords nearly one-third more than the forged metal; which most clearly demonstrates the influence we have assigned to the inferior density; and, 2*d*, That the effects of the streaking upon the two sorts of plates differs not only in intensity, as we had foreseen, but also in *kind*, for if the radiating power of the forged plate received an *augmentation* of four-fifths by the roughening action of the emery, on the other hand, that of the cast silver experienced a *diminution* of nearly one-fifth.

This unexpected result, which irrefragably proves the truth of our fundamental proposition, is most satisfactorily explained by the theory we have just been developing: for the pressure of a hard body, such as the emery, upon the soft surface of the cast metal, somewhat compresses and condenses the rubbed parts, and makes the bottom of the striæ, produced upon the superficial layer, harder than the whole surface of the corresponding plate.

I have to regret that I had not an opportunity of making the same experiment upon vessels of gold and platina, where the same kind of manifestations, in all probability, would exhibit themselves upon a large scale, on account of the very great difference of density we can impart to these metals by means of fusion and percussion.

And now, turning to the first observations of the late Professor Leslie, we observe that the different metallic plates which he subjected to experiment, gave constantly a greater emissive power when they were rough and irregular, than when they were smooth and polished. This being the case, nothing appeared more natural than to conclude, regarding the phenomena of the emission of caloric, that, apart from the influence dependent upon the quality of the superficial layers, there was some peculiar influence dependent upon their degree of polish, so far at least as the metals were concerned. This was the conclusion drawn from the facts observed by Mr. Leslie; and, notwithstanding, this conclusion—so simple and direct in appearance, was unwarrantable.

Here, then, is a beacon where needed, against the unfortunate precipitancy with which some experimenters hasten to dignify as general laws, the consequences which result from their first experiments. Sometimes we have only to take up an instrument and use it in some research, in order to stumble upon some new fact. But in prosecuting the work with becoming assiduity, in varying our modes of experimenting, and in analyzing the phenomenon in different aspects, it will most generally be found, either that the novelty is only apparent, and that the true explanation may be found among the already established truths of science; or if, on the other hand, it turns

out to be a real discovery, it will almost invariably contradict those alleged general laws which first of all presented themselves to our minds with so much apparent certainty and clearness.—(*Comptes Rendus de l'Académie des Sciences.*

Edin. New Philos. Jour.

On the Effects of Light and Air in restoring the faded Colours of the Raphael Tapestries. By Mr. Trull; *communicated by* Michael Faraday, Esq., D. C. L., F. R. S.

To the Editors of the Philosophical Magazine and Journal.

Gentlemen,—You probably remember an exhibition in July last of certain Raphael Tapestries in the Haymaket, and the extraordinary effect the exposure to light and air had in restoring and altering colours which had faded during centuries of exclusion from these mighty agents. I have received letters from the proprietor, Mr. Trull, and if you think parts of them worth publication at this time, when the action of light in the service of the fine arts is so much dwelt upon, they are entirely at your service.

April 21, 1839. Michael Faraday.

To Professor Faraday.

Warwick-row, Coventry, March 12, 1839.

Sir,—The interest you took in observing the changes of colour in the Raphael Tapestries, after being exposed to light in London last July, made me anxious to communicate to you the extraordinary effects since produced, by the simple means suggested by yourself and other scientific gentlemen, of a more perfect exposure to light and air, which have for the last seven months been obtained, in a finely situated factory here.

I feared to trespass on your valuable time, but could not resist, after hearing of the great public interest now excited by the new process, called, I believe, "sun painting."

Light and air have done wonders for my tapestries, in dispelling the damp, clearing up the colours, and reproducing others, obscured by the effects of many years' close packing up in boxes. I regret not to be able to make scientific remarks on the progress of the recovery, which others acquaint-with chemistry might have done.

The results cannot fully be appreciated but by those who recollect the work when up in London, where the first effects of change unexpectedly commenced.

The greens had all become blue; you, Sir, anticipated a return to the original tints, which has, almost throughout, taken place.

The robes and full colours generally had become dull and heavy; this has gradually gone off, and left a brilliancy of colour and beauty of effect hardly to be excelled. The gold also, as you hinted, has become more clear and bright.

The flesh parts of the figures, which had become pallid, almost to white, have recovered the high tint and deep shadow, and the strong anatomical effect of Raphael.

A renewed freshness now reigns over the whole, and the clearing up of the light in many of the landscape parts is most extraordinary, giving a depth and breadth the cartoons themselves do not *now* convey, particularly in the Keys to St. Peter, St. Paul at Athens, and The Death of Ananias; where

extensive landscape, ranges of buildings, and foliage have sprung up, like magic, on parts *quite obscured* when up in London eight months back, much of which is either worn or torn out of Raphael's patterns at Hampton, and painted over, and known only through the means of these Leo Tapestries.

I should have much pleasure in giving you any further information on the subject I am capable of, or in showing the works to any persons taking an interest in them.

I am, &c.,

WM. TRULL.

Coventry, April 17, 1839.

My former letter in regard to the extraordinary changes the Raphael Tapestries had undergone the last seven months, use as you think proper. I regret not being able to give you a scientific description from the first, and the progress; and the absence of a gentleman acquainted with the chemical effects of light and air, to have noted the changes, is much to be regretted both for science and art. The works themselves being unique, and of above three centuries, so placed for so many years in continued damp to effect such mischief to the colours, are circumstances never to occur again.

Some colours entirely changed, others in confusion and apparently gone, yet by the *mere* effects of light and air, slowly and quietly resume the chief of their original tints! Flesh reappears, hair on the head starts up; the grand muscular effect and unique power of expression, only found in Raphael and Michael Angelo, are finely developed where a few months back appeared a plain surface! *Here* are the works, and the facts may be *now* ascertained.

I have applied to the directors of the British Institution, Pall Mall, to permit one or two of these Tapestries to be exhibited with the old masters in June; thus those who saw them last year, may be able to see what they now are, and both science and art may be served; for a comparison has never yet been made, with the tapestry since the Cartoons were repaired and painted upon.

I think, Sir, you will recollect my subject of the stoning St. Stephen, the large masses of blue cloud-like appearance hanging about and over Jerusalem: these have nearly disappeared, and mountain scenery taken the place! The olive grove, which only showed a few trees in front all blue, and a heavy blue-like curtain was over all of the grove; the curtain has disappeared, and a fine deep grove is now seen; the natural green and mossy bank have nearly taken their original state; fresh lights keep breaking out and showing even deeper in the grove! and throughout the works, the original lights are working their way, from the heavier colour.

I remain, Sir, yours, &c.,

WM. TRULL.

ARTICLES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

Movements of Double Stars.

M. Mœdler advanced some researches on the probability of a normal plane of the systems of fixed stars, particularly of double stars.

There are 59 known systems of double stars, of the deviation of whose natural position there is no doubt. Among these 59 systems, 34 have a

direct motion, and 25 a retrograde motion, regarding, according to general rule, N.E. and S.W. as the direct course. If all these luminaries moved in the same plane, the celestial vault would thereby be divided, relative to our sphere of observation, into two hemispheres, in one of which these visible movements would be all direct, and in the other, all retrograde. This movement will always appear the same, whatever the angle of position. We may, therefore, with certainty, and at all times, place each of those stars in one of these two classes, as soon as all doubt is removed respecting the direction of the change in their relative positions. In the poles of this plane one should see the circle of these orbits without any contraction. Under the equator they would appear to us as lines; in every other point as elipses more or less open.

At the first view, it will be perceived that, choose which division we may, both retrograde and direct movements will always remain in the same hemisphere. Researches, therefore, on this subject, can only tend to the discovery of a plane approximating as nearly as possible to the conditions announced; or, to prove that such a plane does not exist.

Now M. Mœdler has found that this plane does exist, that it cuts the terrestrial equator at about 10h. and 22h., and that it is inclined to it from 30° to 35°. He demonstrates the probability of this by various approximations. The indication will doubtless stand in need of being discussed and supported by a great number of facts. L'Institut, No. 235.

Temperature of the Crust of the Earth in Belgium.

By an attention to the daily observations made at the new observatory in Brussels, and comparing them with those of other places, M. Quetelet has been able, as he thinks, to arrange some general propositions which include the actual state of our knowledge, derived from experiment, on the variations of the earth's temperature. They are the following:

1. In descending from the surface, the mean annual temperature gradually increases; nevertheless, immediately below the surface, at the depth of about six inches, there is a stratum whose mean temperature is a minimum.

2. The rapidity with which the annual variations of temperature are transmitted to the interior of the earth, is from 6 to 7 days through a thickness of one foot.

3. Agreeably to the deductions which theory has already pointed out, the differences of the extremes of annual temperature decrease in geometrical progression, at depths increasing in arithmetical progression.

4. The annual variations of temperature come to nothing at the depth of 60 to 75 feet; that is, at or near the stratum where the *maxima* and *minima* of the temperatures happen at the same times as at the surface of the ground.

5. In descending to the depth of several feet, in this climate, the annual variations of temperature are as the sines of the times, supposing the circumference to represent the period of the year. In high latitudes these variations do not descend so low.

6. The velocity of the descent of the *diurnal* variations is rather less than three hours through a bed of the thickness of one decimetre, (=4 inches nearly).

7. The *diurnal* variations of temperature are reduced to nothing at the depth of 13 m, 3 (=51.18 inches) or at a depth 18 times less than that of the extinction of the *annual* variations conformably to theory.

These propositions are developed in a special memoir of the author, entitled, *On the diurnal and annual variations of temperature*, and *in particular, the terrestrial temperature at different depths.* This memoir is inserted in the 10th vol. of the *Memoirs of the Brussels Academy of Science.*

Idem, No. 240.

Variations of Temperature in the Lower Strata of the Atmosphere, at different hours of the day. By M. Marcet.

The experiments were made in 1837, and in the first months of 1838, as follows:

A mast was raised 114 feet high, in the middle of a meadow, at a distance from any habitation. Horizontal pieces were attached to it at every 10 feet from each other, to which thermometers were attached, so that they could be raised and lowered by means of pullies. Their balls were covered with a non-conducting substance, to be certain that their temperature would not vary during the interval of their descent. The results of the observations were:

1. An increase of temperature according to the height, at the period of sunset, is a constant phenomenon, whatever the state of the air, except in the case of violent winds. It had before been supposed that this was the case only under a serene sky.

2. This increase is at its *maximum* at sunset, and at its minimum at sunrise; the difference diminishing as the dew becomes more abundant.

3. The limit in height, beyond which the increase is no longer perceived, does not exceed 100 feet when the sky is clear, and is much less in cloudy weather, especially in winter.

4. The increase of temperature, and the limit of its elevation, vary according to the seasons; the *maximum* being in winter, when the ground is covered with snow.

On the 20th January, 1838, a thermometer placed 2 feet above the ground, stood at 16°.25, and another at the height of 52 feet, was at 8.°25, difference 8°. The mean difference deduced from 12 observations made in very cold weather, of thermometers separated by an interval of 50 feet in height, was 5°.5. A comparison of the temperatures of two strata at 2 feet and 5 feet from the ground, gave a still more remarkable result; the mean of 9 observations was 2°.4 during a period of snow.

These facts explain the observation of some gardeners during the last winter, that trees were frozen near the ground, while the upper branches remained intact.

Idem, No. 243.

Progress of Civil Engineering.

On the Width of Tracks for Railroads. By W. R. Casey, *Civil Engineer.*

Whatever may have been the reasons which led to the adoption of the present width of tracks on the Liverpool and Manchester Railway, it will be readily admitted, that no change can *now* be judicious unless it offer advantages not possessed by, or obviate difficulties inseparable from, the usual gauge of 4 ft. 8½ in. between the rails. The deviations from this width as yet made in the United States, few as they are in number and insignificant in amount, leave us absolutely without any facts by which to show the pro-

priety, far less the necessity, of an increased width of track, in a manner entitled to the confidence of an intelligent Board of Directors. All we can do, then, is to examine the grounds on which the only deviations worthy of notice have been recommended, and wholly, or in part, carried into execution.

These are the Russian Railway, with a track 6 feet wide, constructed by the Chev. de Gerstner, and the Great Western Railway, with a track 7 feet wide, by Mr. Brunel. Unfortunately, no reports of the working of the former have been received in this country, though M. de Gerstner, when here, was decidedly opposed to any increase beyond 6 feet, and on the other hand, Mr. Brunel's confidence in the ultimate and triumphant success of his 7 ft. track remains to this day unshaken.

Mr. Brunel had two objects in view in adopting the seven feet gauge:—the attainment of an average speed of from 35 to 40 miles per hour, and a reduction of the friction of the axles by increasing the diameter of the wheels of the cars—indeed an increased diameter of wheel may be said to be the aim of this very important change, for, by this means is obtained the increase in speed as well as the diminution in friction.

There are, probably, few roads in England on which an average speed of 25 miles per hour, and still fewer in the United States, on which an average of 20 miles per hour, is regularly maintained. The rate of traveling on some of the most important thoroughfares in the Union, such as the Utica and Schenectady Railroad, scarcely reaches 15 miles per hour, though their engines could easily maintain a rate of at least 20 miles per hour; and the engines on good roads, such as the Providence, Stonington, and the numerous substantial roads leading from Boston, could without difficulty, perform 25 miles per hour, or more if required. The speed cannot therefore be said to be limited to its present rate by the narrow gauge, but must be attributed to other causes very well known, some of which are pointed out by Mr. Wood; such as the trifling loads, and the immense consumption, of fuel at great velocities. The repairs of road, engines and carriages, offer, however, still greater objections, for they increase in a much greater ratio than the speed, and in fact limit the velocity, on cheap roads, to 15, and on the best roads in the Union, to 20 miles per hour.

The maximum grade on the Great Western Railroad is 4 feet per mile, on which inclination, the friction of the axles will, as Mr. Brunel says, form 80 per ct. of the resistance, and by increasing the diameter of the wheels from 3 to 4 feet, the friction of the axles will be reduced from 80 to 60 per ct. or inversely as the diameter. (Mr. Brunel appears to have overlooked Mr. Hawkshow's error in stating, that an increase of diameter in the wheel with a corresponding increase in the axle would not diminish the friction—in other words, that the friction is as the area of rubbing surface instead of as the weight.)

There are few, if any, roads of importance in the Union, where the inclinations are not, at least, equal to the angle of repose, and even in this extremely favourable case, an increase in diameter of wheel from 3 to 4 feet would only reduce the friction 20 per ct., supposing the road to be straight, but with inclinations of from 30 to 40 ft. per mile and curves of 1,000 or 2,000 feet radius, the advantages of large wheels would be imperceptible in practice—the disadvantages obvious.

Increased steadiness was one of the collateral advantages confidently anticipated from the wide track. Mr. Wood's experiments cannot be considered as indicating any superiority in this respect, but Mr. Brunel states posi-

tively, that the notoriously worst part of the road gave the most favourable results in the diagrams, and it is indeed very easy to believe that this apparatus for measuring the irregularities of a machine much simpler than itself, and far better understood, would not give any results on which much reliance would be placed by practical men. If the steadiness actually increased with the width, the improvement from an increase of nearly one half should be immediately and plainly perceptible to all, but if it can only be ascertained by a sensitive apparatus contrived for the purpose, this "collateral advantage" disappears in practice. It is remarkable that Mr. Brunel no where states, that the motion on his road is decidedly easier, more agreeable, or more uniform, than on the narrow track.

The want of room for the most efficient arrangement of the working parts of the engine was, some years since, of itself considered sufficiently important to warrant an increase in width of track. Now, however, little or no difficulty is experienced in the construction of the largest engines, and the most experienced builders in England, as well as the United States, consider any increase beyond a very few inches absolutely injurious with the present construction of engines.

The propriety and practicability of maintaining an average velocity of 40 miles per hour and the great benefits to be derived from 4 feet gradients are so strongly urged by Mr. Brunel, that, with every respect for his talents, it is difficult to believe that he has any practical acquaintance with the repairs and renewals of engines and cars, adjustment of rail, average size of trains and numerous other practical details, experience in which, in this country, goes far to demonstrate that his views cannot be carried out, here at least, requiring as they do, in the first place, an immense outlay to obtain 4 feet gradients and curves of several miles radius, and secondly, an amount of repairs and renewals vastly beyond what is already found so burdensome with only half the proposed velocity, and with less than one-fourth of the probable cost.

In justice to Mr. Brunel it should be borne in mind, that he does not consider the wide gauge advantageous for roads materially differing from his in curves and grades, and his entire course of reasoning would lead to the conclusion, that the ordinary width of tracks was too great for roads with grades of 30 feet per mile and curves of 2,000 radius. He also refers to the Irish Commissioners, who, with certain curves and inclinations, established 6 feet and 2 inches as the most advantageous width, and feels sure that, with a line as favourable as the Great Western, the same principles would have induced them to recommend a gauge of seven feet. The idea that for every series of grades and curves a different width of track should be adopted may be very true in the abstract, and may afford infinite amusement to Dr. Lardner, Irish Commissioners, cis—as well as trans—atlantic "et id genus omne," but it has no attractions for those whose deliberate opinions, instead of being confined to paper, are carried out in practice, and in the success of which, they, as well as the stockholders have a vital interest and the community a stake of some importance. Thus if we admit, that 7 feet is the proper width for the Great Western Railway with grades of 4 feet per mile, and that 4 ft. 8½in. is the proper gauge for the London and Birmingham Railway with grades four times as great, or 16 feet per mile, some of the most important roads in this country would be reduced to a width of little more than 3 feet! It is worthy of remark that instead of pointing out the manner in which the present gauge acts injuriously, and stating some tolerable approximation to the extent of increase by which these difficulties would be

surmounted—(an investigation requiring much labor and skill), it is assumed as self-evident, that a wider track must work better than one of the ordinary dimensions, though, for anything deduced from experience in the United States, the most advantageous width is as likely to be found below, as above, 4 ft. 8½ in.

A velocity of 40 miles per hour is not to be thought of, on the railways of the United States; the diminution in friction by increasing the diameter of the wheels will only be felt on a level where it is not of the slightest consequence; there appears to be at least no gain in steadiness, and "gentlemen's carriages" can be carried over the wheels as well as between them.

The success of the new system cannot be considered certain even with the incomparable grades of the Great Western Railway, and it is not easy to say what will justify its introduction on roads with grades of from 18 to 30 and even 40 ft. per mile and curves of 1,000 to 1,500 feet radius, unless we rely entirely on improvements to be hereafter made in the construction of roads and machinery, or anticipate the eventual adoption of a superstructure far more substantial than any now existing; in short a railway of greater capacity than the London and Birmingham, the present business of which may be considered fully equal to what can ever be expected on any railroad in any part of the Union.

But, without reference to any thing which has been said or done in England, how stands the case in the United States? The present width is sufficient for any engines required in practice, and indeed for much heavier ones than any road in this country is able to bear, the wagons are large enough for greater burthens than the wheels and springs ought to be loaded with, and the velocity is limited to its present rate by conditions on which an increased width of track can have at least no beneficial influence. A wider gauge must be attended with increased cost of construction, and if the present superstructure and weight of engines be retained, the same load will be carried at a slight increase of cost on account of the additional capital invested in the width of road, cars, and engines, supposing the cost of repairs and renewals to remain the same as with the present dimensions—a supposition only too favorable to the increased gauge. A greater width of track, with corresponding additional strength in the superstructure and cars, and power in the engines, would undoubtedly enable us to carry at a lower rate than with the present roads, engines, ect.,—if the business could not be properly accommodated by a road of the ordinary dimensions. Before determining therefore on any *material* deviations from the present gauge (which no one supposes to be precisely the very best possible) it should be ascertained that an amount of business might reasonably be expected, which could not be *advantageously* done on a road of the ordinary width.

This subject has been before the Engineering world in this country for at least five years, during which time many of the best roads have been executed, and the very best ones projected and planned. Yet Messrs. McNeill, Whistler & Robinson have retained the 4 ft. 8½in. gauge on all their works, some of which are not yet completed, though they have had in numerous instances, if not in all, a "carte blanche," and were indeed bound by every consideration to have adopted a wider track if it would, in their opinion, have conduced to the efficiency of the road or the interests of the stockholders. In England, the London and Birmingham Railway, the most stupendous work of Internal Improvement on record, has a track of the ordinary width though leading from the heart of the kingdom to the commercial

metropolis of the world, and built by one of the first engineers of the age, who could have introduced any alteration he might have deemed judicious.

The practice of all the best engineers of England and the United States, and the fact that the present dimensions have worked admirably well, must be considered almost conclusive evidence, that there are no *engineering* considerations, which urge the adoption of a wider gauge. Still, another width of track *may* be attended with peculiar advantage, and the success, and almost universal adoption, of the ordinary gauge should not deter us from the cool and impartial examination of a greater width, though it should certainly act as a warning from useless innovations and uncalled-for changes.

Since the above was in type, the writer has had the pleasure of reading the admirable report of Messrs. Knight and Latrobe, on the "principal Railways of the Western and Middle States," and notwithstanding their observations and remarks are confined principally to the proper dimensions of the various parts of the superstructure, repairs of engines, and the general economy of railroads, there is not an expression in the remotest degree alluding to the width of tracks, though the subjects discussed are precisely those on which an increased gauge is to exert so beneficial an influence, whilst the high standing of the authors forbids the idea of their neglecting any consideration so important as the width of track, if they consider any change desirable, or if they had even anything useful, or interesting, to offer on the subject. Am. R. R. Jour.

On the Teeth of Wheels. By Robert Willis, *Jacksonian Professor of Natural Philosophy in the University of Cambridge.*

The geometry of the subject of the teeth of wheels may be considered as complete, but it appears that important additions may be made to its practical applications. The general problem is, having given a tooth of any form to determine one which shall work correctly with it. The method of effecting this may be shewn in a simple practical manner. The curve to be traced out which is the shape of the required tooth, is the locus of the intersections of all the outlines of the tooth in every one of its positions. The motion produced by the mere contact of the curve so traced out with the given tooth will be uniform. This then is a practical mode of shewing the practicability of the problem.

The epicycloids and involutes have hitherto, from the facility with which they can be described, been almost universally employed, and practice has been confined to the class of epicycloids which work correctly with straight lines or circles. The defect under which such wheels labour is, that a wheel of fifty teeth of the same pitch will not work correctly with a wheel of one hundred teeth of the same pitch; since the diameter of the describing circle by which the epicycloid is formed, must be made equal to the radius of the pitch circle of the wheel with which the teeth are to work, and will therefore be twice as large in the second case as in the first. Also, if the teeth be epicycloids, generated by a circle whose radius is equal to that of the wheel with which it is to work, which is equally correct, the same remark applies.

This defect was of no great consequence when the teeth were wooden, but it is of great consequence in iron wheels, since the founder must have a new pattern of a wheel of forty teeth for every combination that it may be required to make of this wheel with others. It is desirable that the teeth of

wheels be formed so that any tooth may work correctly with any other of the same pitch. This is the case with involute teeth, but the obliquity of the action is an objection to their introduction. The requisite property may be given to epicycloidal teeth, by employing the following proposition. If there be two pitch circles touching each other, an epicycloidal tooth formed by causing a given describing circle to roll on the exterior circumference of the first, will work correctly with an interior epicycloid formed by causing the same describing circle to roll on the interior circumference of the second.

From this Professor Willis deduces the corollary, that if for a set of wheels of the same pitch a constant describing circle be taken and employed to trace those portions of the teeth which project beyond each pitch line by rolling on the exterior circumference, and those which lie within it by rolling on its interior circumference, then any two wheels of the set will work correctly together.* This corollary is new, and constitutes the basis of the system already alluded to.

It only remains to settle the diameter of this constant describing circle. The simplest considerations serve to shew that the diameter of the constant describing circle must not be greater than the radius of the pitch circle; hence, as a convenient rule, make its diameter equal to the radius of the least pitch circle of the set. This rule is perfectly general, applying to racks and large wheels, as well as to annular or internal wheels. The simplicity of this above the old system is obvious, for on the old every epicycloid requires two circular templets; also there must be as many templets as pitch circles in the set, whereas on this system but one describing templet is required.

For machinery in which the wheels move constantly in the same direction, the strength of the teeth may be nearly doubled for the same quantity of materials, by disposing it so that the backs are an involute or the arc of a circle, the acting faces being of the usual form.

In the preceding the exact forms have been described; the author then proceeds to ascertain forms sufficiently accurate for practice, and which are arcs of circles. Euler suggested the substitution of arcs of circles of curvature instead of the curves themselves. The portion of a curve employed in practice is so small that a circular arc is sufficiently accurate, provided the centre and radius with which it is struck be determined by some more accurate method than by mere trial. With this view Professor Willis was led to investigate a method in which the nature and properties of curves proper for teeth are entirely neglected, and a simple construction shewn by which a pair of centres may be at once assigned for a given pair of wheels, whence arcs may be struck that will answer the purpose of enabling these wheels to work correctly together.

The nature of the motion produced by the pressure of one circular arc against another is then examined and reduced to that of a system of three rods, the middle one of which is jointed to two others, movable at their other extremity about a fixed centre; and a simple construction is arrived at by which we may always find a pair of centres for which two circular arcs may be struck through any point, which will drive each other truly for a small dis-

* For there is both before and after passing the line of centres an exterior epicycloid working with an interior epicycloid; for before passing the line of centres, the part of the driving tooth *within* the pitch line works only with the portion *without* the pitch line of its follower; and after passing the pitch line the part of the driving tooth *without* the pitch line works with some portion of the follow tooth which is *within* the pitch line.

tance on each side of that point. This point, when the side of a tooth consists only of a single arc, should be on the line of centres. It is however more advantageous that the tooth should consist of two arcs, for then there will be two points at which the action is exact—one a little before reaching the line of centres, the other a little after passing it.

From these investigations the author was led to construct an instrument for setting out the teeth of wheels, which may be used with perfect facility by the workmen, and which has been termed an Odontograph; the application of which is fully described. The paper contains many practical observations connected with this subject, tables, &c., and concludes with some directions for ascertaining the correct form of cutters. Proc. Inst. Civ. Eng.

The Canal Lifts on the Grand Western Canal. *By* James Green, M. Inst. C. E.

The Lift which is the subject of the following paper was erected by Mr. Green in the year 1835, on the Grand Western Canal, and has been in operation ever since. Lifts are not intended to supersede the use of canals in all cases, but in those in which a considerable ascent is to be overcome in a short distance, and in which the water is inadequate to the consumption of a common lock, or in which the funds are inadequate to the execution of the work on a scale adapted to such locks.

This Lift is 46 feet in height, and consists of two chambers, similar to those of a common lock, with a pier of masonry between them; each chamber being of sufficient dimensions to admit of a wooden cradle, in which the boat to ascend or descend floats. The cradle being on a level with the pond of the canal, a water-tight gate at the end of the cradle and of the pond of the canal is raised up, and leaves the communication betwixt the water in the canal and in the cradle free, and the boat swims into or out of the cradle.

The cradles are balanced over three cast-iron wheels of 16 feet in diameter, to the centre of one of which is fitted spur and bevel gear, so that the motion may be given by machinery worked by the hand, without any preponderating weight of water in the cradle, when scarcity of water renders this necessary. To this hand gear is also attached break wheels and a break lever for regulating the motion. For the details of the construction of this machinery, and of the manner in which the Lifts are worked, reference must be had to the drawings.

It is obvious that the weights of the additional length of the suspending chains on the side of the cradle which is the lowest must be counterbalanced; for this purpose there is attached to the under side of each cradle a chain of equal weight per foot with the suspending chain, and this elongates under the ascending, and is shortened under the descending, cradle; thus the disparity in the weights due to the suspending chain is obviated.

It is so arranged that the water in the upper cradle is about two inches below the level of the water in the pond; the consequence of which is, that the upper cradle has a slight preponderance first, sufficient to set the machinery in motion; the weight of this water is generally about one ton; it may however be regulated at pleasure.

The strength of materials is the great desideratum in machinery of this nature, and though the Lift here described is but 46 feet, and the boats about 8 tons, the same method is applicable to much greater heights and larger

tonnage. The advantages of these Lifts over common locks are great economy of construction, and great saving of time and water.

The time occupied in passing one boat up and another down this Lift of 46 feet is three minutes, whereas thirty minutes would be required to attain the rise of 46 feet by locks; thus the saving in time amounts to $\frac{9}{10}$ths for boats of eight tons.

The quantity of water consumed is about two tons, for eight tons of cargo, whereas in common locks it is about three tons of water per ton of cargo; the saving is therefore 22 parts out of 24, or very nearly 92 per cent. If the trade were all downward, there would, by the use of these Lifts, be carried from the lowest to the highest level of the canal a quantity of water equal to the loads passed down.

Mr. Green stated, in reply to several questions, that in some parts of the canal it had been found impracticable to get a sufficient drain to empty the chamber—they were compelled therefore to use a half lock of 18 inches' fall; that there were seven lifts and one inclined plane on the canal, effecting a rise of 262 feet in eleven miles. That he should not recommend them as applicable to boats of more than 20 or 30 tons. The width of larger boats was an obstacle. They were extremely advantageous for narrow canals; for boats of 50 or 60 feet in length and about 30 tons.

Mr. Parkes remarked, that he considered the question of narrow canals as a most important one—the advantage to be derived from narrow canals was a subject to which sufficient attention had not been paid.

The President called attention to the remark in Mr. Green's paper respecting the quantity of water carried up from one level to another in a downward trade wherever these Lifts are used; then a coal country on high level may supply itself with as much water as it sends down coal. The subject of inclined planes being alluded to, especially those of the Morristown Canal of 200 feet each, where a rise of 1600 feet is effected by eight inclined planes, Mr. G. remarked that more water and time must be expended, the friction and length being much greater. In the Lifts there was only as much water consumed as was equal to the load, but that he should not consider them as practically applicable to more than 60 or 70 feet. Favourable levels with ascents of more than 60 or 70 feet could seldom be found; could he have had the choice of the line in this particular instance, he should have effected by four lifts the rise for which seven are now employed. Ibid.

On the Ventilation of Tunnels. By W. West.

This paper contains an account of some experiments on the temperature of the air in a tunnel on the Leeds and Selby Railway. There are three shafts in the tunnel; and he observes, the temperature of the external air being 34°, the temperature at the mouth and as far as the first shaft was 34½°, but that immediately beyond this shaft it rose to 35°, and increased uniformly up to the farther end, at which point it was 57°. From this fact the author infers that the air passed up the shaft, and that the tunnel would be more completely ventilated without any shafts; and that shafts generally are an impediment to perfect ventilation. Ibid.

"*On the relative Heating Powers of Coke and Coal in Melting Glass.*" *By* Apsley Pellatt, Assoc. Inst. C. E.

The object of this paper is to confirm some statements of Mr. Parkes as

to the calorific power of coke and coal from experience of the authors in melting glass. The great loss of heat arising from the flame and unconsumed gaseous portions of the fuel being driven up the flues, when the furnaces are heated by coal, and the fact that coke succeeds better than coal in annealing glass, determined the author to persevere for a month in heating the furnaces with coke, and to compare the result with those obtained when the best coal was employed.

The construction of the furnace and the arrangement of the pots and flues are described. The furnace is somewhat reverberatory, being between an air furnace and an oven; the smoke and flame not escaping at the top, but being drawn to flues betwixt the pots, which are set round in a circle. For the purpose of obtaining sufficient heat about the points and sides of the pots, there are small holes, called "bye-holes," through which the flames should play outward in a length of 5 or 8 inches. The healthful action of the furnace is indicated by the length of the flame issuing from the bye-holes and tops of the flues. Great care is requisite in regulating the supply of air, too much air endangering the pots, too little checking the heat of the furnace. The bars were obliged to be placed at 2 inches apart instead of $1\frac{1}{2}$; the greater concentrated heat of the coke not only requiring more air, but having a tendency to melt the bars; lumps of fire-brick also were thrown in to supply the deficiency of clinkers. To make, however, the flues and bye-holes draw well, it is necessary to use $\frac{1}{5}$th of screened coals with $\frac{4}{5}$ths of good coke, by measure. The following is the result:—For nine months the consumption of coals for a 7 pot furnace was 18 tons per week. For four months, on the new system, the consumption was $10\frac{1}{2}$ tons of coke, and 5 tons of screened coal per week. Deducting then these 5 tons, it appears that $10\frac{1}{2}$ tons of coke are of the same value as 13 tons of coal, or there is a saving of near 20 per cent. in the weight of fuel, and a superiority of 25 per cent. in the heating power of the coke above that of coal. Considerable advantage is also derived from the saving of the pots and in other incidents peculiar to the manufacture of glass.

Mr. Parkes observed that the preceding statements had more than confirmed his results. From the statements of Mr. Pambour, on whose data his calculations had been founded, it appeared that gas coke was inferior to Worsley coke by $12\frac{1}{2}$ per cent.; in his reasonings he had allowed 20 per cent. as the difference betwixt good coke and coal; but according to the results given by Mr. Pellatt, that allowance ought to be $32\frac{1}{2}$ per cent. He was of opinion that the advantage to be ascribed to the screenings was part chemical and part mechanical. The coal would fill up the interstices of the coke, and prevent the air from escaping unconsumed.

Mr. Pellatt remarked, that the safety of the pots was a very important consideration. By the terms hard and soft coke, he understood foundry and gas coke; the former gave a much more intense heat, and lasted longer. The coke he had used was gas coke, and about 14 cwt. to the chaldron. Mr. Fox stated that the coke in use on the London and Birmingham Railway is about the same weight. It was stated that coal which lost $\frac{1}{4}$th in weight gained $\frac{1}{4}$th in bulk by coking. Ibid.

Obituary Notice of M. Malinvaud, Engineer in the Royal Mining Corps.

By M. F. Le Play, *Mining Engineer.*

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

More than eighteen months have elapsed since the Corps of Mines lost in M. Malinvaud one of its youngest members, and one of the most devoted to his country's good; in calling to mind, at the present time, the particulars of his life, we are sure of exciting a profound sympathy in the breasts of all who knew him. We feel more forcibly, every day, that the memory of so noble a spirit ought to be religiously preserved; and the serious duty which we have just accomplished in interrogating the recollections of his friends, will have furnished us, if need be, with the proof of this assertion.

Jean-Firmin Malinvaud, was born at Limoges, on the 8th of September, 1807, and early distinguished himself by a rapid progress in his studies in the Royal College of that city. His professors having observed in him a peculiar aptitude for the mathematical sciences, encouraged him to offer himself for admission to the Polytechnic School. He entered it in 1826, after a single examination, and in the same year, in fact, in which he had attended the course of philosophy in the College. This admission, was, however, rather premature. Classed, on his entrance, in advance of his promotion, he soon discovered with pain, that he could not successfully follow the prescribed course. A fruitless effort of three months almost discouraged him, and his career would thus have been arrested at its commencement, if he had not summoned to his aid, and given an early demonstration of, that ardour in study, and that power over his own will, which distinguished him through life. Seconded by the admirable organization of classes, which is the principal secret and the most powerful means of polytechnic education, he applied himself incessantly in obtaining from his comrades that instruction which the lessons of the teachers could not yet supply him; but in a short time these lessons were no longer difficult or obscure; he gradually became qualified to render to other students, less happily organized than himself, the same assistance which had given a spring to his own faculties. At the opening of the second year of his studies, he was promoted to the grade of sergeant or chief of his room; and was finally classed in the fifth rank at the closing examination.

This success allowed him to pursue the vocation which his station in the polytechnic school had revealed to him, and three years later, he came from the school of mines the first on the list of those who had entered it with him.

The scientific journies which he took in 1830 and 31, first with M. Baudin, and afterwards with M. M. Baudin and Harlé, completed his theoretic knowledge, and initiated him in the practice of his art. His observations in the course of these two journies, furnished two excellent journals of travel, and four memoirs, which were the prelude of his more important labours as an engineer.

One of these memoirs drew the attention of the committee on the Annales des Mines, and was published in that collection in 1833, under the title of "*Memoirs on the position, exploration, and treatment of the iron ores in the Valley de l'Aubois*" (*Cher.*) Very different opinions existed at that time among geologists with respect to the epoch of the formation of that prodigious formation of iron in granular, fragmentary, and nodular masses, generally known under the improper appellation of alluvial ore,

which exists in a notable portion in the soil of France, and which supplies the greater number of our air furnaces.

It was a disputed question whether these ores all belonged to the same or to different formations; and the partizans of the first hypothesis were no less divided with respect to the period which should be assigned to these deposits, since their suppositions referred to the whole series of strata comprised between the diluvial formation and the upper portion of the Jurassique. In his memoir on the Valley of Aubois, Malinvaud discussed all these opinions with that soundness of judgment for which he was distinguished, and which is more indispensable perhaps in geology than in any other branch of natural science. This memoir contributed not a little to settle the opinion now generally entertained, that there does exist, indeed, ores called *alluvion* in all the strata comprehended between modern alluvions and jurassique formations, but that the ores of the Valley of Aubois, and in general, of Nivernais and Berry, as well as a great part of the iron ores of our other provinces, belong to the middle stage of tertiary formations.

Having become a sub-engineer, Malinvaud was charged, at the close of 1832, with the ordinary service of the Loire. But at the time even of his arrival at Saint Etienne, his health had become seriously affected; an attack of cholera had left a chronic inflammation of the stomach, which had been aggravated by the loss, which he most sensibly felt, of a beloved mother. Nevertheless, the duties of his new station, to which he devoted himself with that ardent zeal which animated him in all his labours, produced at first a beneficial diversion from his sufferings.

The eminent qualities of the new engineer of the district of Saint Etienne, were soon appreciated by the overseers of that rich basin, when an unforeseen circumstance brought them more distinctly into view. The chief engineer of the department, M. Delsériès, having been obliged temporarily to leave la Loire, the service of the department was confided, par interim, to his young substitute. Without being dismayed by this heavy task, the latter applied himself to its fulfilment in such a manner as to conciliate the esteem of the overseers. He succeeded in maintaining with them the friendly relations favourable to the progress of the service, without departing from that conscientious firmness of principle, which was one of the prominent traits of his character.

He exhibited this firmness, still more rare than science and talent, when he had to claim the intervention of the judicial authority to put an end to two illegal enterprizes, by which the safety of several of the inhabitants of the town of Saint Chamond would have been put to hazard.

At Rive-de-Gier, the vicinity of a great body of subterranean water, rendered a certain mining operation, which the proprietors were not in a hurry to abandon, very dangerous. Malinvaud pointed out the extent of the danger, and induced the prefect to signify to the lease holders that they must close their mine. At the moment when this notification was going into effect, the frail obstacles which had hitherto protected the labourers, yielded suddenly to the pressure of the water, without producing however, any serious accident; and our associate had thus the satisfaction to prevent one of those catastrophies unhappily so frequent in subterrannean labours.

This late accident which the young aspirant had so skilfully foreseen, was but one of numerous such cases to which the district of Rive-de-Gier was subjected. In this coal basin, one of the richest of continental Europe, some of the pits, previously very prosperous, were every year submerged by the

subterranean waters; and the greater number of those that remained were threatened with complete invasion. Justly alarmed at a state of things, resulting solely from the negligence and dissension of the overseers, the administration which had not yet availed themselves of the law of 27th April, 1838, wished to ascertain fully the cause and progress of the evil, and to find the proper remedy. In order to throw light upon this question, which might be considered as a vital one to the manufacturing region of central France, the director general of roads and bridges appointed a committee, consisting of M. M. Delsériès, Combes, Clapeyron, Malinvaud and Sénarmont. Malinvaud took an active part in the interesting and important labours of this committee.

At the same period, a deplorable occurrence opened to him a new career. Our unfortunate comrade, Jabin, was killed in a shaft of the mine *Bérard*, and his death left vacant the chair of chemistry and metallurgy in the mining school of Saint Etienne. Malinvaud was appointed his successor. What a sad and striking resemblance! Jabin, only 31 years of age, was removed from a service which he loved by an event as grievous as unexpected; and four years afterwards a similar catastrophe gave a death blow to his successor in the chair, which they had both so worthily occupied.

Malinvaud had a particular predilection for chemistry, and the possibility of realizing some important experiments which he had in his mind, enhanced in his estimation the value of his appointment. He received at the same time the news of his promotion to the rank of engineer. His health seemed to be confirmed; and three months afterwards, he married at Lyons, Miss Camilla Kerris, sister of the engineer of that name, attached to the corps of naval construction. His admission into this excellent family, realized his fondest wishes. The eminent moral qualities with which he was endowed, and those of his companion, enabled him to enjoy in this union that domestic happiness which was to him the greatest of all blessings.

An important mission having been entrusted to the professor of the geological course, Malinvaud undertook to perform the greater portion of it, and during the whole of the Scholastic year 1833-34, he acquitted himself of his double duty in a distinguished manner; and all who witnessed his professional career, admired the method, the clearness and the precision of his instructions. A chastened ardour, a constant solicitude induced him to regard his avocations not only as a duty, but as a high calling. The time not occupied in his chair or in the operations of the laboratory, was devoted to the completion, by means of private instruction, of his public teaching, at the expense of his repose. He gathered, at least, that sweet reward which he was ambitious to acquire. The respect and affection of his pupils, at first surprised at his rigidity, were secured; their remarkable progress determined at the general examinations, in presence of M. Beaunier, inspector general of mines, and then director of the school of mines, enabled him to appreciate the eulogiums of this worthy judge of substantial merit.

In devoting himself to his professional duties, Malinvaud had undertaken to make comparative trials of the properties of the coal extracted from the principal coal basins of France; he had constructed a gasometer, in order that the results, obtained on a large scale, might be immediately applicable to the arts. But he was unable to reap the fruit of his labours. A devotion to his laboratory too long protracted, and above all, the fatigues of his professorship, had again deeply affected his health; an irritation of the larynx became manifest; but Malinvaud, at first, paid but little attention to it, and continued with no less industry, his chemical course during the

second year. But the disease became so serious, that in March, 1835, he was obliged to relinquish his functions as professor. The activity of his disposition did not, however, allow him to give up to repose, whatever need he had of it. He wished only for a change of occupation, and the director general acceded to this desire, and assigned to him the service of the district of Chalons-Sur-Saone.

An abode in a milder climate than that of La Loire, and the interest which his mineralogical district, with its manufacturing industry afforded him, reacted at first favourably on his health; a temporary amelioration took place in October, 1835; but unhappily consulting nothing but his zeal for active labour, he exposed himself to imprudent fatigue, and in the intervals of long and frequent excursions among the mines, he received with eager complaisance the overseers who were not tardy in estimating the high capacity and the utility of his counsels, which he lavished with a devotedness for which they cherish a grateful recollection. He did not perceive that this new kind of professorship was bringing upon him a renewal of his fatal disease.

An accident altogether unforeseen, hastened its return, and impressed upon it a character much more serious.

In July, 1836, Malinvaud visited the mines of Epinac. Desirous of ascertaining the exact condition of the *Curier* pit, he wished to make a descent by one of the buckets, instead of going down the ladder, as is usually practised in that mine. Unhappily the lower bucket, whose motion is the reverse of that which descends from the opening of the pit, had not been unhooked, so that in the middle of the pit, 300 feet from the bottom, it caught that which contained Malinvaud and the director of the mine. The workman, in his confusion, not having stopped the motion of the machine, the descending bucket, still hanging to the other, was overturned so as to become horizontal. Our unfortunate associate was thus completely overturned; his head was caught between the bucket and the walls of the pit, his mouth was cut, the hook of his mining lamp pierced his under lip and broke a tooth. A moment after, the two buckets separated, but so suddenly, that the rope, if it had not been new, would infallibly have been broken. The bucket, impelled by this shock, swung many times against the wall, and in these rapid movements, Malinvaud had his left hand wounded and his right side greatly bruised.

From that time he did not recover even the appearance of health, and could not fail to become aware of his situation. This conviction is discoverable in the following lines addressed to the director general, who had kindly asked of him an account of the injury he had received.

"Such are, Mr. Director General, the details of this accident: it has produced a reaction very unfavourable to the disease with which I was affected; for since that time I have begun to spit blood in greater quantity than before."

He wrote these lines in the early part of 1837, on his return from a journey to Creuzot, made in December and January. He had not till then decided on quitting the service to which he had formed so strong an attachment.

To this, however, he was compelled; but scarcely was he established in Paris before all prospect of a cure of his malady was given up. He at first concealed this painful conviction for fear of afflicting his family and friends. He continued to receive visits from numbers of the overseers of Saone-et-Loire; he loved to confer with them on their operations, and to give them ad-

vice. We have witnessed the eagerness with which his counsels were sought after, and the affectionate interest manifested by the overseers, who were permitted to see him in these, his declining hours.

It was at length necessary to declare to his afflicted family that all restoration appeared impossible: supported by a piety worthy of his character, he resigned himself with calmness to this precocious reversal of his happiness, and the loss of that future worldly happiness which had appeared so beautiful in prospect. The most trying part of this sacrifice was the renouncement of the delightful task of educating by his own paternal care two twin daughters, still in their infancy. Preserving to the last moment the exquisite sensibilities of his heart, he exhorted, in the midst of severe suffering, his beloved wife, and his adopted mother, to a resignation to their allotment. For a long time he wished to conceal from his father and brother, who were at a distance, the danger of his situation; but obliged at length to undeceive them, he devoted the remainder of his strength in writing to them in the most touching strains of a final separation.

It was chiefly in the last period of his life that we were able to appreciate the extent of the loss which awaited us. The talents for which Malinvaud was more eminently distinguished, was a quick penetration, and great rectitude of judgment, seconded by a memory so powerful, that all those who, with ourselves, shared in his studies, had to acknowledge that they had never met with one so remarkable. He brought to the performance of his engineering duties a rigidity of principle, which rendered still more severe the sentiment of honour instilled by a polytechnic education. A ...ildness and a kindness which were never mistaken, gave an inexpressible charm to his manifestations of friendship, and all those virtues of the private friend were enhanced by a nobleness of disposition which preserved unspotted, the candour and benignity of his heart.

A life so pure, and so advantageously spent, continued but 29 years! Malinvaud died the 14th of March, 1837, calm, resigned, and in a peaceful sleep, as he had desired.

Annales des Mines, tom xiv. liv. vi.

Mechanics' Register.

Screw Propelled Steam Ship.

The steam-ship Archimedes (230 tons N. M.), Minter, arrived here yesterday from London. She is fitted upon a new principle with her machinery, which is the invention of T. Smith, Esq., and manufactured by Messrs. Rennie. The vessel is at present propelled at the rate of ten knots by the log, with a screw working upon an horizontal axle in the after run of her, the screw making 150 revolutions in the minute. The time taken on her trip down here was as follows:—From London to Gravesend one hour and forty minutes, and from Gravesend to the Nore one hour and thirty minutes. The steam can be raised from the time of lighting the fires in thirty-five to forty minutes. The engines are two forty-fives, and for every revolution of the engine the screw makes five and one third turns. The machinery is placed nearly down upon the keelson, and admirably protected on each side the vessel by coal boxes eight feet through, being a grand consideration for vessels of war fitted on the above principle. She is intended to cruise up and down the coast for one week to improve her trim and increase her speed,

of which the inventor has not the least doubt. The vessel is beautifully modelled, and were it not for the appearance of her funnel she might be taken for the Phantom Ship gliding quietly over the surface of the deep, scarcely leaving a ripple behind her. Naut. Mag.

New Apparatus for Stopping Carriages.

Several highly successful and satisfactory experiments have lately been made of a very ingenious invention, having for its object the prevention of accidents from horses taking fright, starting, or running away. The machinery, with but trifling expense, can be applied to carriages, cabs, or any other description of vehicles. Its mode of operation is as follows,—On the nave of the wheel is fixed a small gun metal wheel; in front of the axle runs a steel spindle, with a small cog attached; over the spindle is a cylinder, and to which the pulley or check string is affixed. The moment it is put in action, the spindle advances, and the cog revolves gradually round the gun metal wheel, which is affixed on the nave, carrying with it reins leading from the horse's head, composed of cat-gut, or patent cord, covered with leather. As the wheel revolves, the cylinder, which is about an inch in diameter, is gathering up the reins, until the horses are brought to a stand still; when, by letting loose the check string, the horses immediately have their heads free. The security of the invention may be imagined when it is stated, that a child inside the carriage can with ease, and at pleasure, stop the most spirited and powerful cattle, supposing the reins to be broken, or the coachman's command *over* a vicious or unruly team overcome.

Farm. Mag.

Voyage of the Ship "Ironsides."

This, the first sailing vessel constructed of iron which has ever been dispatched to encounter the risk of a transatlantic voyage, and which left Liverpool some five months since, for the Brazils, entered the Mersey on the 1st of May. The homeward passage from Aricati was accomplished in forty days, which is considered to be no despicable achievement, as during the whole trip light winds prevailed. The return of the "*Ironsides*" has completely established the practicability of navigating the ocean safely and surely in ships constructed of iron; the compass, whose action it was predicted would invariably be deranged, worked correctly; and the superiority of the material of which she is built, is proved by the fact, that from the day on which she sailed for Pernambuco, during the time she remained at the Brazils, and in the course of her voyage home, on no one occasion was it necessary to use the pumps; in fact, her hull is absolutely and literally water tight. This indemnity against leaking is no unimportant advantage, the proof of it, occurring too, as it does, at a time when timber is scarce, and consequently dear. So little has the "*Ironsides*" suffered from exposure to wind and weather, that her external appearance would induce the opinion that she had but lately been launched. Her tonnage is 264 tons; draft of water aft, 8ft. 7 in.; forward 8 ft. 3 in.; her cargo consists of 1,800 bales of cotton. Mec. Mag.

New Light for Light-houses.

A letter of the 10th of March from Trieste, states that a new system of

producing light for light-houses has been invented by a serjeant-major in the Austrian artillery, named Selckonsky. The apparatus consists of a parabolic mirror, 62 inches by 30, with a twelve-inch focus, and the light is produced by a new kind of wax candle, invented by M. Selckonsky. It has been tried under the inspection of the Austrian Lloyd's Company in the port of Trieste, by being erected on the mast of a vessel. The light is said to have illuminated the whole of the port and the surrounding parts of the town equal to the moon at full, and at the distance of six hundred yards the finest writing could be read. A second trial has been made in bad weather, and the result was proportionably favourable. Ibid.

Mechanic's Fair, Boston.

The second exhibition of the Massachusetts Charitable Mechanic Association for the encouragement of Manufactures and the Mechanic Arts, will be opened at Quincy Hall on Monday, the 23rd of September, 1839.

Those intending to offer articles for premium or exhibition, are requested to give early notice to the Secretary, Mr. J. G. Rogers.

All articles intended for exhibition must be delivered to the Superintendent, William Washburn, at Quincy Hall, on, or previous to, Wednesday the 18th of September, accompanied by an invoice, and a particular description of all new and important inventions, or improvements in the articles offered.

Steam power will be provided to put machinery into operation, and premiums will be awarded to the makers of articles deemed most worthy of that distinction by competent judges. Those offered by apprentices, will have a division especially appropriated to them. George Danacott is the President of this Institution.

We had the high gratification of visiting the first exhibition of this Society, which took place at a period of much depression among the manufacturers, and after a very brief notice, but the exhibition itself furnished no evidence that such was the state of affairs. Its success was most perfect, far surpassing the anticipations of its warmest supporters, the spacious apartments which it occupied having been, from first to last, crowded by admiring visitors. There can be no ground for apprehension therefore, that the approaching exhibition will not afford a display of which every American may be proud.

Annual Exhibition of the American Institute, New York.

The twelfth Annual Fair of this Institution will be opened at Niblo's Garden on the 7th of October 1839.

Contributions from exhibitors will be received on the Thursday, Friday, and Saturday, immediately preceding. The Anniversary Address will be delivered by the Hon. Samuel Southard, on the evening of the 10th. The Silk Convention will be held on the evening of the 11th. On the first Thursday of September, there is to be a Ploughing Exhibition at Harlem, at 2 o'clock, P. M., under the auspices of the Institute.

To the spacious accommodations afforded at Niblo's Garden, there have been added for the purpose of this exhibition, two rooms, each measuring 110 by 25 feet. There has also been provided, contiguous to the garden, accommodations for the exhibition of cattle of pure breed, for horses, and for any extraordinary breeds of sheep, swine, &c.

LUNAR OCCULTATIONS FOR PHILADELPHIA, OCTOBER, 1839.					Angles reckoned to the right or westward round the circle, asseen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
14	8	46	Im. τ Sagittarii	4	152°	188°
14	9	38	Em.		247	290
17	8	28	Im. δ Capricorni	3.4	175	183
17	9	20	Em.		257	276
28	13	15	Im, γ Cancri	5	109	54
28	14	13	Em.		223	168

Meteorological Observations for April, 1839.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	31	58	30.20	30.20	E.	Moderate.		Clear—do.
	2	46	59	29.90	29.95	N.E.	Brisk.		Partially cloudy—clear.
	3	41	53	30.10	30.10	E.	Moderate.		Cloudy—do.
	4	50	66	30.10	30.10	E.W.	do.		Partially cloudy—clear.
	5	47	76	30.05	30.05	S.E.	do.		Foggy—clear.
☽	6	47	69	30.15	30.10	S.W.	do.		Clear—clear.
	7	49	74	29.90	29.80	S.W.	do.		Clear—do.
	8	46	59	29.90	29.95	N.	Brisk.		Clear—do.
	9	36	58	30.05	30.05	N.	do.		Clear—do.
	10	38	65	30.10	30.05	S.W.	do.		Cloudy—hazy.
	11	50	76	29.90	29.85	W.	do.		Clear—lightly cloudy.
⊗	12	59	60	29.60	29.41	S.	do.	1.00	Rain—drizzle.
	13	46	44	29.50	29.60	N.E.	do.	.27	Rain—do.
	14	36	47	29.74	29.74	N.W.	do.		Drizzle—cloudy.
	15	40	59	29.75	29.65	W.	do.		Partially cloudy—clear
	16	42	64	29.65	29.60	W.	do.		Clear—do.
	17	43	43	29.25	29.34	S.E.W.	Brisk.		Cloudy—do.
	18	37	49	29.50	29.70	W.	Moderate.		Clear—do.
	19	40	50	29.76	29.80	W.	do.		Clear—do.
☾	20	43	71	29.70	29.65	W.	do.		Clear—do.
	21	36	52	29.95	30.00	E.	do.		Clear—do.
	22	34	64	30.20	30.20	S.	do.		Clear—do.
	23	37	67	30.34	30.34	S.E.	do.		Clear—do.
	24	46	75	30.10	30.05	S.W.	Brisk.		Clear do.—thunder shower.
	25	50	72	29.90	29.86	W.	do.		Clear—do.
	26	47	69	29.86	29.90	W.	Blustering		Clear—do.
	27	50	76	29.85	29.80	W.	Brisk.		Clear—do.
☉	28	52	62	29.70	29.70	W.	do.		Lightly cloudy—do. do.
	29	48	64	29.90	30.00	E.	Moderate.		Cloudy—partially do.
	30	48	62	29.85	29.80	S.E.	do.		Cloudy—do.
	Mean	44.03	62 77	29 88	29.88			1.39	

	Thermometer.	Barometer.
Maximum height during the month.	82. on 28th.	30.34 on 23d.
Minimum " " "	31. 1st.	29.25 17th.
Mean	53.40	29.88

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

AUGUST, 1839.

	County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barometer. 7, A. M.	2, P. M.
1	Philadelphia,														
2	Montgomery,														
3	Bucks,	Newtown,	L. H. Parsons.	71.13	78.66	66.64	87.	53.	72.67	.	48.	60.02	1	30.	30.
4	Lehigh,														
5	Northampton,														
6	Monroe,	Stroudsburgh,	A. M. Stokes.	60.29	76.86	63.31	86.	51.	66.82	15½	.....	.....	.	29.51	29.51
7	Pike,														
8	Wayne,														
9	Susquehanna,	Silver Lake,	E. Rose.	63.42	75.42	67.87	86.	47.	68.90	.	44.	57.68	.	28.12	28.12
10	Luzerne,														
11	Schuylkill,	Pottsville,	John Porter.	61.68	73.32	63.39	86.	41.	66.13	.	43.	56.48	.	29.20	29.20
12	Berks,	Reading,	C. F. Egelman.	65.87	72.42	63.84	83.	52.	67.04	.	....	.....	.	29.79	29.78
13	Chester,														
14	Delaware,	Haverford,	Haverford School,												
15	Lancaster,	Lancaster,	Conservatory of Arts,	66.23	77.43	68.38	87.	53.50	70.68	½	50.50	63.04	.	29.52	29.52
16	York,	York,	Calvin Mason.	71.90	75.56	69.89	89.	56.	72.45	.	55.	64.93	.	29.58	29.61
17	Lebanon,														
18	Dauphin,														
19	Northumberland	Northumberland	Andrew C. Huston.	65.82	74.42	67.00	82.	52.	69.08	.	44.	57.80	.	29.48	29.47
20	Columbia,														
21	Bradford,														
22	Tioga,														
23	Lycoming,														
24	Union,														
25	Mifflin,	Lewistown,	J. Culbertson, M. D.	70.85	74.69	72.58	82.	60.	72.71	⅓	....	.....	.	29.32	29.30
26	Juniata,	Mifflintown,	J. A. Kinkead.	68.19	75.35	70.18	83.	57.	71.24	1⅔	....	.....	.	29.55	29.48
27	Perry,														
28	Cumberland,	Carlisle,	Prof. W. H. Allen.												
29	Adams,	Gettysburgh,	Prof. M. Jacobs.	64.13	71.83	66.63	84.75	50.25	67.53	.	43.25	58.63	.	29.43	29.42
30	Franklin,	Chambersburg,													
31	Huntingdon,														
32	Centre,	Bellefonte,	John Harris.	61.14	76.73	64.38	85.	41.	67.50	4	33.	48.55	22	29.29	29.29
33	Potter,														
34	M'Kean,	Smithport,	Richard Chadwick.	56.55	73.58	57.51	85.	42.	62.55	.	38.	51.77	.	28.22	28.24
35	Clearfield,														
36	Cambria,														
37	Bedford,														
38	Somerset,														
39	Indiana,	Indiana,	Richard White.	66.39	70.26	67.03	80.	55.	67.89	.	40.	54.10	.	28.67	28.65
40	Jefferson,	Rose Cottage,	C. C. Gaskell.	58.81	73.39	62.26	84.	44.	64.82	.	....	....	.	28.96	28.96
41	Warren,														
42	Venango,														
43	Armstrong,														
44	Westmoreland,														
45	Fayette,														
46	Green,														
47	Washington,														
48	Alleghany,														
49	Beaver,														
50	Butler,	Butler,	Jacob Mechling,	61.18	75.24	67.69	86.	44.	68.04	.	...	....	.	....	....
51	Mercer,														
52	Crawford,														
53	Erie,														

LUNAR OCCULTA… O…

Day.	H'r.	Min.	
14	8	46	Im.
14	9	38	Em.
17	8	28	Im.
17	9	20	Em.
28	13	15	Im.
28	14	13	Em.

Meteo…

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.
	1	31	58
	2	46	59
	3	41	53
	4	50	66
	5	47	76
☽	6	47	69
	7	49	74
	8	46	59
	9	36	58
	10	38	65
	11	50	76
⊗	12	59	60
	13	46	44
	14	36	47
	15	40	59
	16	42	64
	17	43	43
	18	37	49
	19	40	50
☾	20	43	71
	21	36	52
	22	34	64
	23	37	67
	24	46	75
	25	50	72
	26	47	69
	27	50	76
	28	52	82
☹	29	48	64
	30	48	62
	Mean	44.03	62.7

Maximum height during
Minimum "
Mean "

	Thermometer.										Barom…			
							Register.							
	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.
	15	78.66	66.64	87.	53.	72.07	.	48.	60.02	1	30.	30.	30.01	30.2
	29	76.86	63.31	86.	51.	66.82	15 1/2	.....	.....	.	29.51	29.51	29.53	29.6
	42	75.42	67.87	86.	47.	68.90	.	44.	57.68	.	28.12	28.12	28.14	28.45
	68	73.32	63.39	86.	41.	66.13	.	43.	56.48	.	29.20	29.20	29.21	29.47
	87	72.42	63.84	83.	52.	67.04	.	....	.....	.	29.79	29.78	29.79	30.05
	23	77.43	68.38	87.	53.50	70.68	1/2	50.50	63.04	.	29.52	29.52	29.53	29.77
	90	75.56	69.89	89.	56.	72.45	.	55.	64.93	.	29.58	29.61	29.62	29.85
	82	74.42	67.00	82.	52.	69.08	.	44.	57.80	.	29.48	29.47	29.47	29.75
	85	74.69	72.58	82.	60.	72.71	1/2	....	.....	.	29.32	29.30	29.31	29.60
	19	75.35	70.18	83.	57.	71.24	1 1/2	....	.....	.	29.55	29.48	29.51	29.80
	13	71.83	66.63	84.75	50.25	67.53	.	43.25	58.63	.	29.43	29.42	29.44	29.68
	14	76.73	64.38	85.	41.	67.50	4	33.	48.55	22	29.29	29.29	29.29	29.56
	55	73.58	57.51	85.	42.	62.55	.	38.	51.77	.	28.22	28.24	28.24	28.54
	39	70.26	67.03	80.	55.	67.89	.	40.	54.10	.	28.67	28.65	28.67	28.90
	31	73.39	62.26	84.	44.	64.82	.	....	....	.	28.96	28.96	28.94	29.40
	8	75.24	67.69	86.	44.	68.04	.	...	....	.	....	....	....	....

Barometer.						Weather.							Winds.																Hygrometer.					
9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
30.01	30.22	29.64	30.	1⅔	11	19	1	....	....	....	..	6.800	.	.	4⅔	.	.	.	2⅔	.	.	.	2⅓	.	1	.	7⅔	.	.	12⅓	65.32	7	.....	....	.	890
29.53	29.65	29.25	29.52	14⅔	6⅔	9	15⅓	....	....	....	..	5.760	2	.	1⅓	.	1	.	1	.	1	.	1	.	2⅓	.	5⅓	.	.	16	....	.	.....	62.12	23	843
28.14	28.45	27.81	28.13	.	10	21	.	....	....	....	..	2.570	2½	⅔	.	.	.	.	.	.	6	½	11	.	6⅓	⅓	4	.	.	.	....	.	.....	....	.	840
29.21	29.47	28.86	29.20	.	12⅔	18⅓	.	11	....	....	..	4.821	⅓	.	2⅔	.	1⅓	.	2⅔	.	3⅓	.	2	.	4⅔	.	1⅔	.	12⅓	.	....	.	.....	....	.	817
29.79	30.05	29.42	29.79	.	9⅓	21⅔	.	7	....	....	2	2.949	3½	.	4⅓	.	⅓	.	6⅓	.	.	.	6⅔	.	⅔	1⅓	7⅔	.	⅓	.	....	.	.....	....	.	810
29.53	29.77	29.13	29.52	⅓	15	15	1	9	....	....	1	3.135	1	4⅔	4⅔	⅓	2	⅓	1⅔	1	2	1½	2⅓	1	1⅔	1⅓	2⅔	⅔	.	2⅓	64.98	2	.....	68.86	2	816
29.62	29.85	29.27	29.60	.	.	.	.	....	....	....	..	3.240	⅓	.	7⅓	.	⅔	.	.	.	.	.	3	.	2⅓	.	17⅓	.	.	.	47.35	.	.....	....	.	812
29.47	29.75	29.11	29.47	.	8	22⅔	⅓	12	....	....	1	2.525	8	⅔	1	.	2⅔	.	⅔	⅓	5	.	.	.	2⅔	.	4⅓	1	4⅔	.	....	.	.....	66.72	.	850
29.31	29.60	29.00	29.31	⅓	9⅔	5⅔	15⅔	....	....	....	..	....	⅓	.	8⅓	.	.	.	7⅔	.	2⅓	.	6⅓	.	⅓	.	3⅓	.	.	2⅓	....	.	.....	....	.	836
29.51	29.80	29.18	29.51	3⅔	11	12⅔	7⅓	....	....	....	..	....	½	.	5	.	.	.	3½	.	.	.	4⅔	.	⅔	.	7⅔	.	5⅔	3⅔	....	.	.....	....	.	809
29.44	29.68	29.11	29.43	.	11⅔	19	⅓	4	....	....	9	6.133	6	1⅔	1	⅔	⅓	.	.	⅔	3	1	3	⅔	2	1	1⅔	⅔	8	.	60.12	.	.....	65.49	.	813
29.29	29.56	28.97	29.29	4	10	17	4	....	....	....	..	....	2⅔	.	7	⅔	1⅓	⅕	1⅓	.	1	.	5	.	3	½	4⅓	.	.	4	....	.	.....	....	.	832
28.24	28.54	27.90	28.23	.	12	19	.	8	....	....	1	1.460	⅕	.	4⅕	.	5	.	3	.	⅓	.	1⅗	.	8	⅕	2⅓	.	5⅗	.	69.83	8	.....	71.06	.	820
28.67	28.90	28.40	28.68	.	18	13	.	....	....	....	..	6.376	2	.	1	.	⅔	.	2⅔	.	.	.	.	.	7	.	1	.	16⅔	.	....	.	.....	....		819
28.94	29.40	28.62	28.95	.	11⅓	18⅔	1	....	...	....	..	5.900	⅕	.	⅕	.	1⅗	.	1⅕	⅕	⅕	⅕	2⅕	.	5⅓	⅕	3⅓	⅔	3⅔	10⅔	55.26	.	....	65.71	.	846
....	....	....	....	.	.	.	.	....	....	....	..	....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	....	.	....	....	.	814